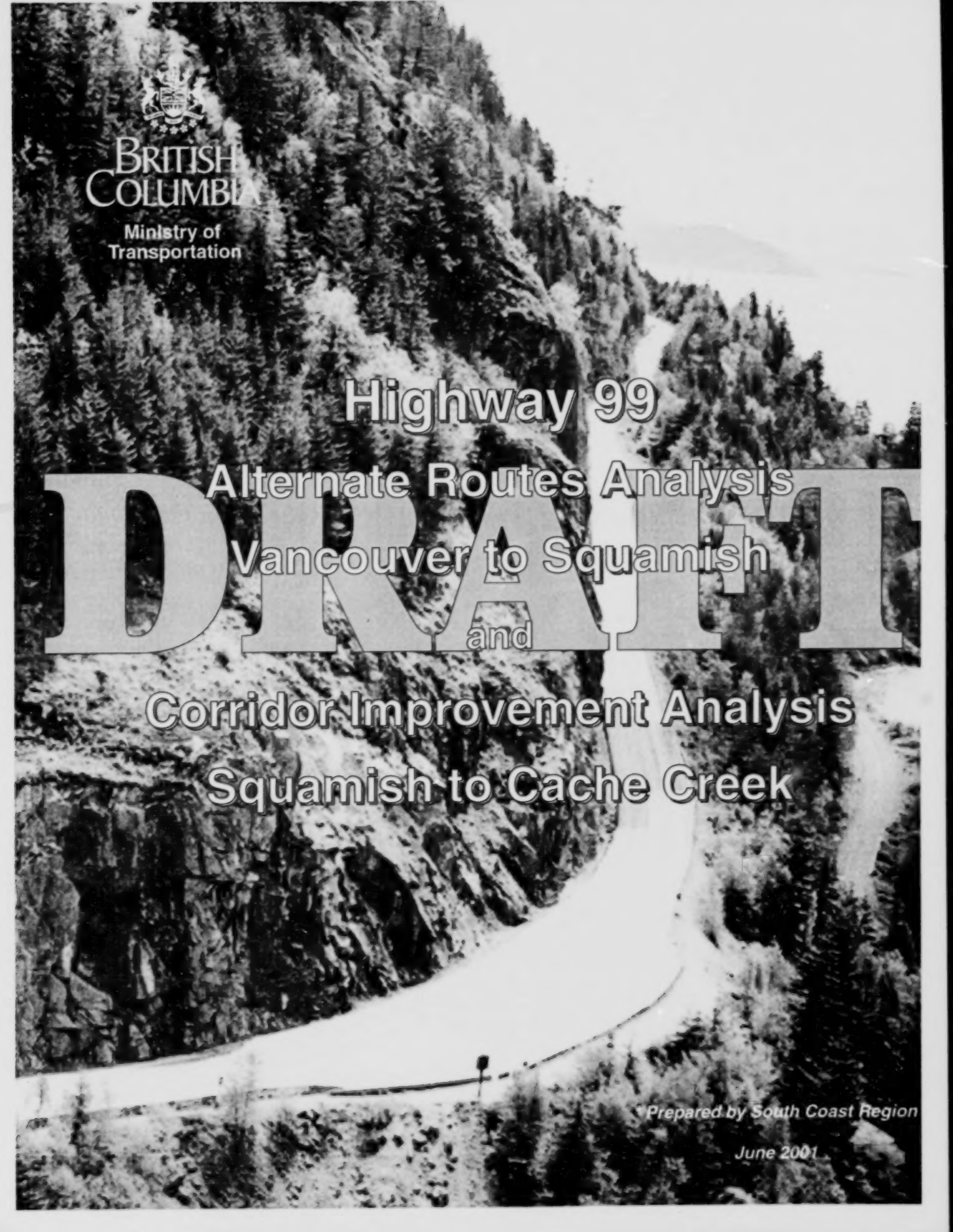

BRITISH COLUMBIA
Ministry of Transportation
Highway 99
Alternate Routes Analysis
Vancouver to Squamish
and
Corridor Improvement Analysis
Squamish to Cache Creek
DRAFT
Prepared by South Coast Region
June 2001

105-01582/

Contents

	page
1. Introductory Background	3
2. ***Executive Summary Cost Estimates***	4
2.1 Design Criteria	
2.2 Total Route Upgrading Cost	
2.3 Hybrid Seymour-Indian River Route	
2.4 Reduced Squamish to Whistler Upgrading Cost	
2.5 Cost Estimating Accuracy	
3. Vancouver to Squamish Route Options	10
3.1 Cost Estimates	
3.2 Previous Consultant Studies	
3.3 Qualitative Route Comparison	
3.4 Environmental Review Processes	
3.5 Maintenance and Operational Cost Comparison	
3.6 Private Sector Involvement and Route Tolls	
4. Sensitivities and Issues	
4.1 Highway Engineering	14
4.2 Geotechnical ...rock cuts, debris flows, slide areas, aggregates, etc.	17
4.3 Environmental ...legislation, watershed issues, spotted owls, etc.	20
4.4 Snow Avalanche and Highway Operations	23
4.5 Structures	25
4.6 First Nations	27
• Tsleil Waututh Nation	
• Squamish First Nation	
• Lil'wat Nation (Mount Currie Band)	
• Cayoose Creek Band	
• Xaxli'p First Nation (Fountain Band)	
• Ts'kw'aylaxw First Nation (Pavillion Band)	
• Stuctwesemc Bonaparte Band	
4.7 Road and Bridge Maintenance	31
4.8 Properties	31
5. Previous Relevant Studies	32
• 1983 (MoTH) Vancouver to Squamish	
• 1987 (Reid Crowther) Pemberton to Lillooet	
• 1989 (Hamilton) Vancouver to Squamish	
• 1990 (MoTH) Indian Arm Alternate Route	
• 1991 (Klohn Leonoff) Indian Arm Alternate Route	
• 1991 (Hamilton) Squamish to Whistler	
• 1992 (Klohn Leonoff) Caulfield to Furry Creek	
• 2000/2001 (Reid Crowther) Horseshoe Bay to Highway 97	
• 2001 (Earth Tech) Horseshoe Bay to Highway 97	
Appendices:	
A – **Vancouver to Squamish Alternative Routes**...Project Cost Estimates	36
B – **Squamish to Highway 97**...Project Cost Estimates	37
C – **Vancouver to Squamish Alternative Routes**...Route Comparison	38
D – **Detailed Cost Estimating Sheets (Wolski methodology)**	44
E – **Project Team Members**	61

1. Introductory Background

In **1983**, the Ministry of Transportation and Highways (MoTH) carried out a conceptual study of the Vancouver to Squamish highway corridor, which identified three alternative routes in addition to the existing Highway 99 corridor. As a follow up, the Ministry commissioned Hamilton & Associates in **1989** to upgrade this study into a planning and pre-design engineering study, evaluating and ranking the options. This subsequent study concluded that the Indian Arm route, and improvement of the existing Highway 99 corridor, are the two best-ranked options. In **1990**, the Ministry undertook a further geotechnical evaluation of the Indian Arm Corridor option, and in **1991**, Klohn Leonoff Ltd. was retained to more rigorously assess the advantages and disadvantages, capital and maintenance costs, as well as the risks, frequency, and intensity of natural hazards along the two alignments. Subsequently, Hamilton & Associates was asked in **1991** to extend the planning and pre-design study to cover the Squamish to Whistler section of Highway 99. Also, in **1992** Klohn Leonoff Ltd. was retained to further study the existing Highway 99 alignment from Caulfield (North Vancouver) to Furry Creek and to prepare a functional design for upgrading the highway to a four-lane facility.

A Preliminary Route Comparison Study, assessing three route options for a highway link from Pemberton to Lillooet was done in **1987** by Reid Crowther & Partners Ltd. Subsequently the Duffey Lake route was upgraded as the Highway 99 link and this has since been paved. The Whistler to Pemberton section and the connection from Lillooet to Highway 97 have had little previous study for costs of upgrading.

During **2000-2001**, the Ministry of Transportation and Highways and the B.C. Transportation Financing Authority (BCTFA) initiated a Highway 99 Multi-modal Corridor Transportation study, and retained Reid Crowther (Earth Tech) to undertake the work. In April of **2001**, Earth Tech completed a further report for the Ministry regarding short-term improvements that could be made to the highway corridor.

The possibility that Whistler may host the 2010 Winter Olympics will be decided in July of 2001. The highway infrastructure demand, and associated costs, in support of such an event are issues for which more detailed information is required. This, together with potential future development opportunities in opening up the region northwards towards Lillooet and the Central Interior of the province, require updating of previous consultant work and the addition of missing information.

In support of the **Vancouver Whistler 2010 Bid Transportation Work Group** the Ministry of Transportation and Highways has agreed to provide the Transportation sub-committee with information. The following was requested:

- Indian Arm/Indian River Route (4C)
  …update Klohn Leonoff's cost estimate to Class D, with environmental mitigation cost
- Combined Seymour – Indian River Route (3A)
  …produce 1:20,000 route alignment, profile drawings, Class D cost estimate, and environmental mitigation costs
- Capilano Route (2C)
  … produce 1:20,000 route alignment, profile drawings, Class D cost estimate, and environmental mitigation costs
- Whistler – Lillooet and Connection to Highway 97
  … produce 1:20,000 route alignment, profile drawings for a two-lane roadway with 80 km/h standard and maximum 8% grades (plus passing lanes), Class D cost estimate, and environmental mitigation costs

Note: This report only compares the route selection from the North Shore to Squamish and beyond, and does not include the improvements for the Burrard Inlet crossing to the North Shore. It should be noted that the improvements required to the Burrard Inlet crossing are common to all options. Furthermore, for the long term all options will require improvements to the Burrard Inlet crossing with a much-improved North-South Regional roadway through the GVRD with connections to Highway #1, 91 and 99.

2. *Executive Summary Cost Estimates*

The total extent of the project is about 307 km of highway (Vancouver to Highway 97 near Cache Creek). The scope of the project was as follows:

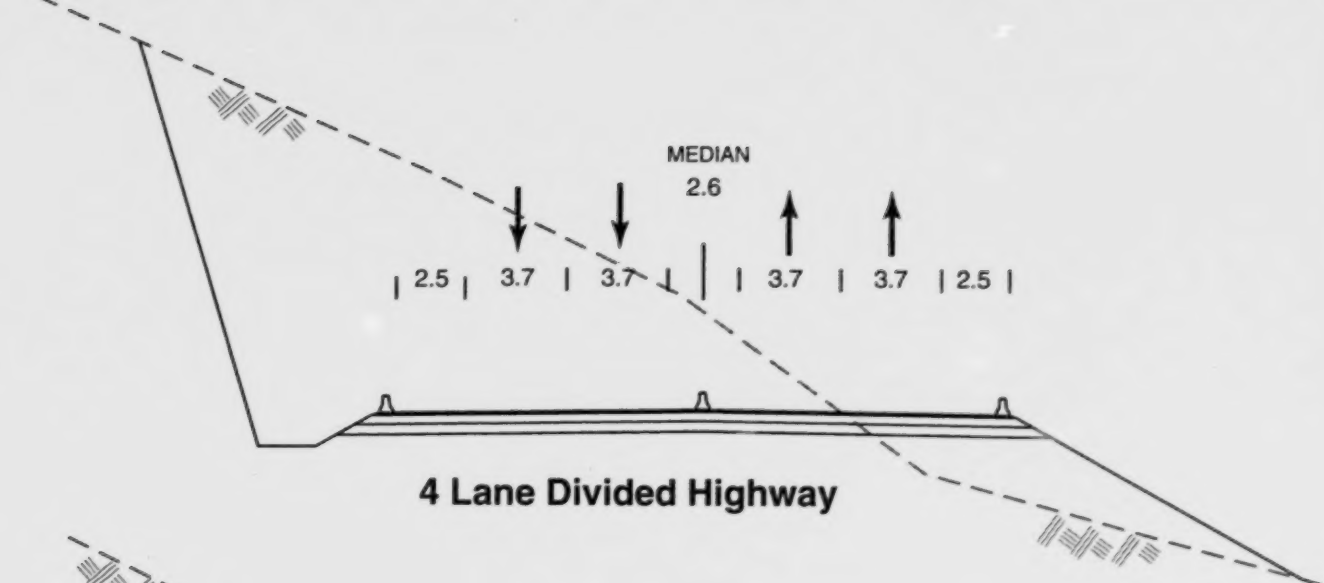
- To ascertain the relevance, completeness and validity of the basic assumptions and evaluation criteria used in the previous studies. This includes changed conditions, current traffic conditions, First Nations impacts, geotechnical and snow avalanche conditions and up-to-date information regarding highway network planning;
- To update previous studies' cost estimates;
- To prepare a new discussion report for the route from Whistler to Lillooet, and the connection to Highway 97; and
- To prepare a total cost estimate for the route. This will include project management, design and engineering cost (total project cost estimates).

2.1 Design Criteria

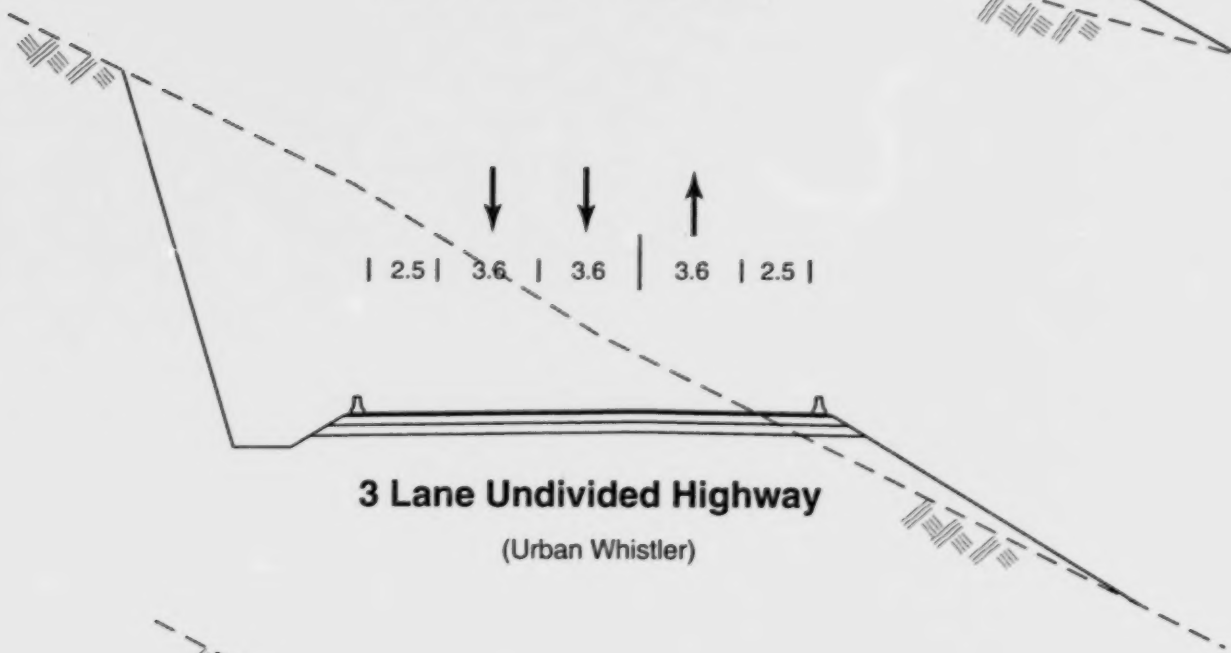
Based on the most recent information regarding highway capacity requirements to the 2025 horizon year as provided in the Reid Crowther (Earthtech) report of 2001 (see Section 5.7 of their report), we have limited the design criteria as follows:

- Vancouver to Squamish (Brackendale)
  ...90 km/h, **four-lane** (with truck climbing lanes added but no additional passing lanes), full grade separation, median barrier throughout, maximum 8% grades, minimum 2.5 metre paved shoulders.
- Squamish (Brackendale) to Whistler (Function Junction)
  ...90 km/h, **four-lane** (without truck climbing lanes or additional passing lanes added), median barrier throughout, maximum 8% grades, railway grade separation, minimum 2.5 metre paved shoulders.
- Urban Whistler (Function Junction to Whistler Village north)
  ...70 km/h, **three-lane** (two lanes southbound, plus turning lanes, acceleration and deceleration lanes); 1.5 metre paved shoulder
  ...80 km/h, **two-lane** by-pass of Whistler (to Green Lake) ... (same criteria as the next section to Pemberton)
- Whistler to Pemberton
  ...80 km/h, **two-lane** (with truck climbing lanes), maximum 8% grades, railway grade separation, minimum 2.0 metre paved shoulders.
- Pemberton to Highway 97
  ...80 km/h, **two-lane** (with truck climbing lanes but no additional passing lanes), some curve signing to 60 km/h (no less), maximum 9% grades, railway grade separation, minimum 1.5 metre paved shoulders.

The following page illustrates typical cross-section templates for a 2-lane, 3-lane, and a 4-lane facility.

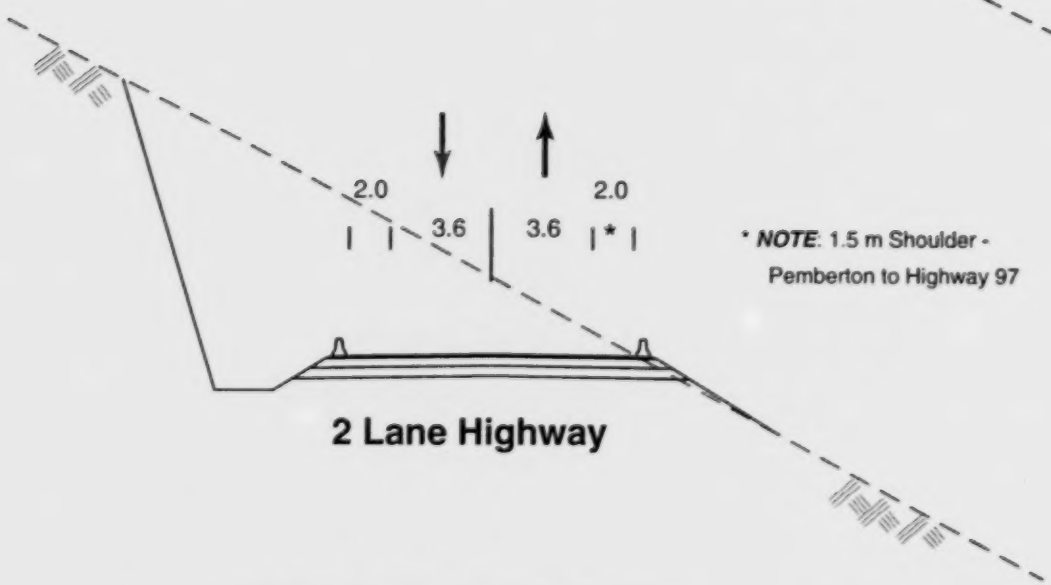


4 Lane Divided Highway



3 Lane Undivided Highway

(Urban Whistler)

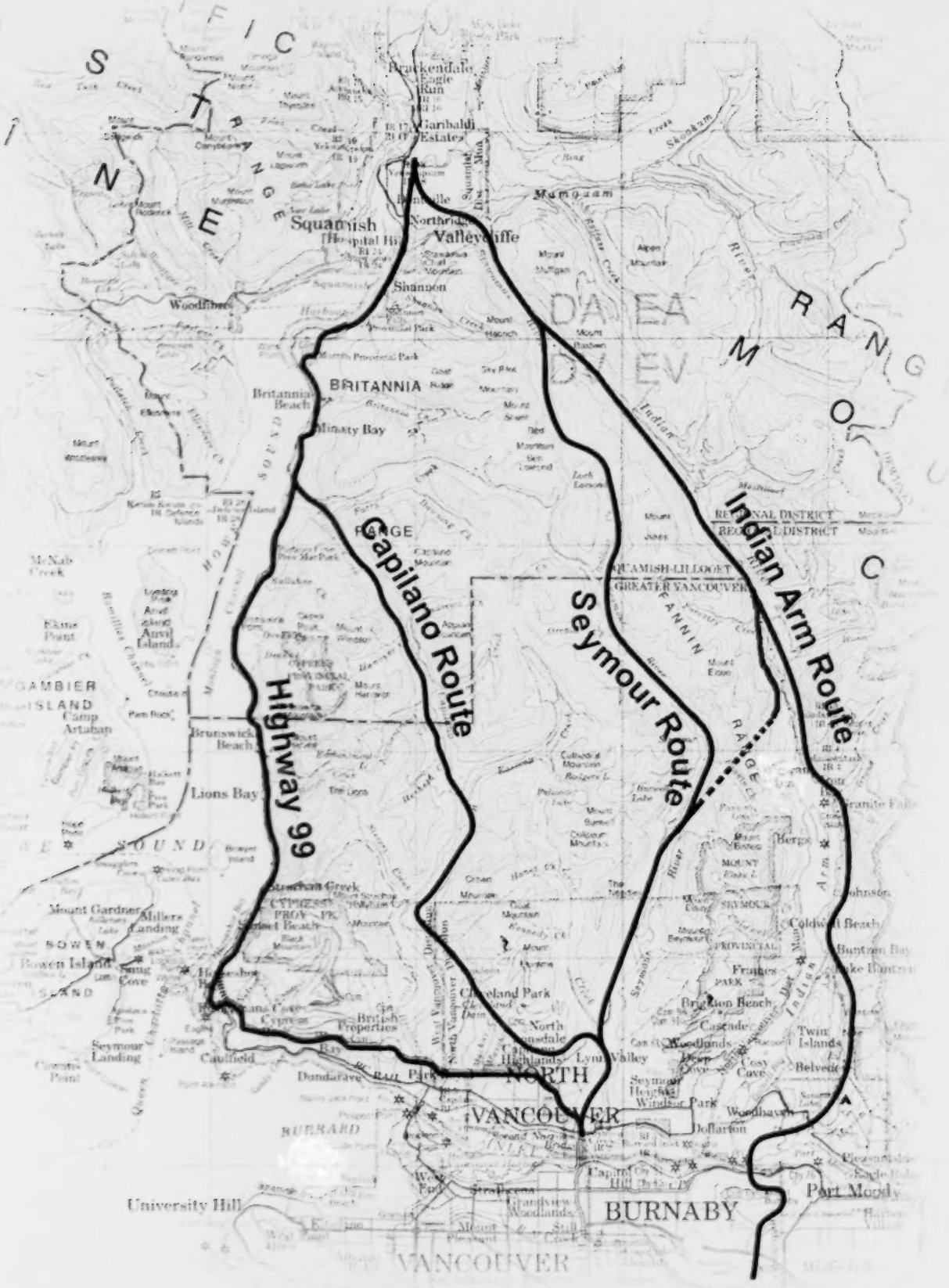


* ***NOTE***: 1.5 m Shoulder - Pemberton to Highway 97

2 Lane Highway

TYPICAL SECTIONS

Not to Scale


Highway 99
Capilano Route
Seymour Route
Indian Arm Route
Squamish
Britannia Beach
Minaty Bay
Lions Bay
Brunswick Beach
Gambier Island
Anvil Island
Mount Gardner
Millers Landing
Caulfield
Dundarave
British Properties
Cleveland Park
North Vancouver
Lynn Valley
Seymour Heights
Windsor Park
Woodlands
Dollarton
Cascade
Twin Islands
Belvedere
Cosy Cove
Port Moody
Burnaby
University Hill
Vancouver
Howe Sound
Indian Arm
Mamquam
Shannon
Woodfibre
Garibaldi Estates
Brackendale
Eagle Run
Northyards
Valleycliffe
Mount Seymour
Mount Fannin
Mount Burnaby
Mount Strachan
Mount Hollyburn
Mount Gardner
Mount Harvey
Mount Hanover
Mount Habrich
Mount Brunswick
Mount Sedgwick
Mount Bishop
Mount Crickmay
Mount Cayley
Mount Lagoon
Mount Thompson
Mount Garibaldi
Mount Dickson
Mount Roberts
Mount Matthews
Mount Brew
Mount Bruce
Mount Bowen
Mount Strachan
Mount Seymour
Mount Fromme

2.2 Total Route Upgrading Cost

The following table sets out the approximate route upgrading costs:

- Part A (Vancouver to Squamish)...all routes connect to Highway 1 at Vancouver

◊ via Highway 99 corridor (maximum tunnel length 2.5 km)	$ 1,294 Million
◊ via Capilano River (maximum tunnel length 0.6 km)	$ 2,299 Million
◊ via Seymour River (maximum tunnel length 4.5 km)	$ 3,855 Million
◊ via Indian Arm/Indian River (maximum tunnel length 1.7 km)	$ 3,900 Million

These costs are set out in more detail in **Appendix A** It should be noted that the above costs are informational only, and should not be used to compare the total cost of all highway access from Vancouver to Squamish. Even if Highway 99 were not upgraded at all, in favour of one of the alternate routes, there would be six lanes of highway to Squamish (two on the existing highway and four on the new route). If Highway 99 is upgraded as the option, then there will only be four lanes of highway to Squamish.

- Part B (Squamish to Highway 97 near Cache Creek)

◊ Squamish to Whistler	$ 370 Million
◊ Whistler to Pemberton	$ 62 Million
◊ Pemberton to Lillooet	$ 537 Million
◊ Lillooet to Highway 97	$ 137 Million
◊ total	$ 1,106 Million

These costs are set out in more detail in **Appendix B**.

2.3 Hybrid Seymour-Indian River Route

We have also prepared a cost estimate for a hybrid option, which would connect the Seymour Route (from just south of the Seymour Dam) to the Indian Arm/Indian River Route (just north of Indian Arm Provincial Park) via an ***8.4 kilometre*** twin two-lane tunnel, as follows:

Construction	Bridges & Snowsheds	Special Mitigation	Engineering	Properties	Management Reserve	Project Sup./Mgt.	**Total Hwy. Section**
$2,946,460,775	$212,739,386	$120,000,000	$216,252,680	$35,650,000	$174,968,341	203,859,112	**$3,910 Million**

This route would have the advantage of avoiding the lengthy drinking-water watershed for the Seymour River, as well as the highest pass (and higher snowfalls) at the route summit. It would also avoid the expensive crossing of the Burrard Inlet near Burnaby Mountain, the Buntzen Lake Recreational Area, the Indian Arm Provincial Park and the lower estuary of the Indian River. It would retain the other issues identified with those route options. The issues created by an 8-kilometre long tunnel would require special attention. Among these:

- this tunnel will probably intersect the Britannia Shear zone
- fire suppression, ventilation and lighting will be a large cost
- round-the-clock emergency response may be necessary at each portal
- ALL dangerous goods would have to be prohibited from using this route

Our rough estimate for this tunnel alone is $ 756 Million.

2.4 Reduced Squamish to Whistler Upgrading Cost

The design criteria used for the Squamish to Whistler portion of the route are as set out in Section 2.1. Since the recent Reid Crowther (Earthtech) report (Hybrid option page 9-2) suggests that a 4-lane facility is not needed before 2025, we have prepared a rough cost estimate for a **three-lane** option (alternating passing lanes or truck climbing lanes) as follows:

Construction	Bridges & Snowsheds	Engineering	Properties	Management Reserve	Project Sup./Mgt.	**Total Hwy. Section**
$230,816,800	$23,775,360	$16,913,300	$19,000,000	$11,938,800	$15,918,400	**$318 Million**

Note: This cost is $52 Million less than the 4-lane option shown in Appendix A, or on the previous page.

It should be also be noted, however, that there are significant operational and safety concerns with a three-lane facility in this terrain as follows:

- A number of agencies have recommended continuous median barrier due to the severity and frequency of head-on collisions occurring on the highway corridor. Motor vehicle incidents are four times as prevalent as rock fall on the route from Vancouver to Whistler. From time-to-time it is expected that there will be lane closure due to rock falls, vehicle incidents or stalls, road maintenance requirements, etc. There will be need to respond to incidents by the police, with emergency vehicles and with maintenance equipment so there must be breaks in the continuous barrier for those purposes/uses only. We would approach detailed design with continuous median barrier as a set objective.

- There will be roadside barrier in many locations due to the terrain, or to protect from rock fall catchment areas and the potential for rock to "bounce" toward the traveled lanes. Roadside barrier in the latter case is also used to prevent vehicles from stopping on the shoulder in the rock fall hazard area.

- There is incompatibility between the above two issues with respect to highway operation for a single lane facility, except as is used for very short sections on low-speed facilities such as access ramps, parking areas, etc. The potential for blockage of the single lane, and inability to access the incident site to remove the blockage, or for vehicles caught in the queue to move around or get away, is too great otherwise. This is especially true in the terrain of the Squamish to Whistler section of Highway 99 where there will be occasional rock falls, serious snow and icing conditions from time to time, and vehicle breakdowns or incidents.

- The use of alternating passing lanes (where truck-climbing lanes are not required) could lead to serious highway safety issues, particularly on this highway corridor. Where

traffic volumes are high enough to produce "platooning" of traffic behind slower moving vehicles, the passing areas will lead to speeding behavior. Where traffic must merge at the end of the passing lane, there will be serious conflicts of differential speed. In an area where road surface conditions due to snowfall and icing is a significant issue for a good portion of the year, the passing lane merge points will be safety hazard sites.

An optional way in which to deal with the control of capacity for this section of the Highway 99 may be to introduce HOV/bus lanes where possible (I.E. restrict use of the additional lanes). This would have to carefully consider the need for truck climbing lanes in addition to the GP (general-purpose traffic) lanes in many locations.

2.5 Cost Estimating Accuracy

The estimating of total costs for the four alternative routes from Vancouver to Squamish was done by extracting quantities from a Digital Terrain Model prepared from TRIM mapping at a 1:30,000 scale. The accuracy of the contour lines on TRIM mapping could vary in the range of 10-20 metres. Accordingly, the accuracy of the quantities of cut and fill thus obtained could vary substantially. However, on undisturbed natural terrain, the impact applies equally to all options and hence the estimates should provide better results than a per kilometre estimate as was used on previous studies. For the improvement of Highway 99 from Horseshoe Bay to Squamish, the Klohn Leonoff 1992 functional design extracted quantities from topographic mapping at a 1:1,000 scale.

In all other areas from Squamish to Highway 97 the existing highway provides the basic corridor for any upgrading to be done. In these areas TRIM mapping would not provide a level of accuracy that would give a true indication of costs when reconstructing along the existing corridor. Due to the contour interval on TRIM mapping it is difficult to appreciate and define the characteristics of the road prism and elevation of the centerline of an existing road. The cuts and fills would mostly be within the same contour line. Here, unit road construction costs per kilometre have been developed using recently constructed or designed sections of the highway as examples for different complexities of terrain, and by calculating the major common unit costs per lane such as gravel, asphalt and drainage. Then, estimates were made of rock cut heights, difficulty of construction, etc. based on field reconnaissance, photolog viewing, orthophotography and Trim map contours. The costs for the new alignments have then been added to give an overall construction cost (by using the 'Wolski' cost estimating method).

Miscellaneous items such as project management, engineering and contingencies, have then been derived as a percentage using the same basic percentage that the 'Wolski' method generates.

It should be noted that it was not possible to determine fully where some minor alignment modification could be made to reduce the volumes of rock excavation, or to reduce tunnel lengths. This was done as best as was possible at this level of detail. In addition, it will be possible to reduce some volumes at detail design due to the use of split grades and further separated alignments. This report has already assumed the use of many separated alignments for the existing Highway 99 from Horseshoe Bay to Squamish. The existing highway may be used for southbound lanes when upgraded, and the northbound lanes would be in a tunnel or on a split grade (slightly higher elevation) to reduce both tunneling length and rock excavation volumes. It is expected that more of these adjustments can be made during detailed design.

3. Vancouver to Squamish Route Options

This portion of the route from Vancouver to Highway 97 consists of five options for the section from Vancouver to Squamish as follows:

- via Capilano River/Hwy.99 — 59 km
  ...referred to as the **Capilano option**
- via Seymour River/Stawamus River — 55 km
  ...referred to as the **Seymour option**
- via Indian Arm/Indian River/Stawamus River — 67 km
  ...referred to as the **Indian Arm/Indian River option**
- via existing Highway 99/Highway 1 — 69 km
  ...referred to as the **Highway 99 option**
- via existing Seymour River/ tunnel/Indian River/Stawamus River — 57 km
  ...referred to as the **Hybrid Seymour-Indian River option**

Note: The distances above reflect different end points. For the Capilano, Seymour, Highway 99 and Hybrid Seymour-Indian River options we show a distance from the Fern Street Interchange in North Vancouver and for the Indian Arm/Indian River option it is from the Stormont Interchange in Burnaby.

3.1 Cost Estimates

Previous studies were reviewed to bring cost estimates up-to-date, and the previous design criteria was modified significantly. Previous studies had assumed a 100 km/h facility for the Capilano, Seymour and Indian Arm/Indian River options, and 90 km/h for the existing Highway 99 upgrade, while we have used 90 km/h for all five options. While this allowed the alignment to be shifted around some snow avalanche paths and other natural hazards, and to reduce the size of rock cuts, we also found some increases to cost estimates as follows:

- the requirement for retaining walls is now estimated to involve approximately 20% of the length of each of the alternate routes. In addition, split grades should be investigated at detailed design to minimize the cost of rock excavation or retaining walls, along with further alignment separation (eg. Northbound tunnel; Southbound existing highway, or excavation on rock), in order to reduce costs where possible.
- The cost estimates per lineal metre of tunnel that were used previously ($41 Million per kilometre of twin two-lane tunnel) are now considered much too low. Based on more recent research, experience and advice, $80 Million has been used for tunnels up to 3 kilometres in length. This was increased to $85 Million for tunnels of lengths between 3 and 6 kilometres, and $90 Million for those over 6 kilometres in length. In addition, we have attempted to reduce or eliminate tunneling wherever possible and only include these where necessary to achieve vertical gradient, avoid extensive through cuts, or for side hill cuts where the height will be significantly greater than 45 metres.

Changes we have attempted to incorporate to reduce costs include separation of the alignments of northbound versus southbound lanes, which has the effect of dramatically reducing tunneling requirements and rock excavation volumes. We have also modified other design criteria as follows:

- reduction of paved shoulder widths from 3.0 metres to 2.5 metres.
- increase of acceptable grades from 6% to 8%.
- complete grade separation (Freeway standard) to Squamish

In the case of watersheds, and the possibility of traversing these, we believe the previous studies were overly optimistic regarding costs to do so. Also, regarding First Nations interests, and potential cost for mitigation, these were mostly ignored or judged in the early 90's to be insignificant.

3.2 Previous Studies

It should be pointed out that previous studies had assumed that up to 8-lanes was required to serve the Vancouver to Squamish traffic demands to 2014. This assumed that another route would be found to construct a 4-lane connection that would complement a 4-lane upgrading of the existing Highway 99 corridor. In other words the total cost of upgrading the connection to Squamish was to be the sum of BOTH.

The traffic projections used in the previous studies were far too high, and this has been proven out over the intervening years. The recent Reid Crowther (Earthtech) study now suggests that 4-lanes is sufficient for this section of Highway 99 to 2025. Construction of an additional route from Vancouver to Squamish is not warranted based on more recent traffic projection information. When, and if an alternative route is required to satisfy capacity demand between Vancouver and Squamish, information from this report may be useful in pursuing one of the alternate route options.

The following Section of this report discusses the route options in more detail.

3.3 Qualitative Route Comparison

We also prepared a Route Comparison Summary, as outlined in Appendix C. The Table on the next page outlines the comparison briefly. Note that all factors have equal weighting for comparison purposes only, so the sum of the points does not reflect an appropriately balanced evaluation but rather compares the issues and impacts. This is not a true multiple-account evaluation, and such should be undertaken if one of the alternate routes is selected for further investigation. Ranking or weighting of the factors should involve extensive stakeholder consultation.

Note that all five options will lead to the need for other network improvements. The Highway 99, Capilano, Seymour and Hybrid Seymour-Indian River options will all lead to an early requirement for increased capacity on Highway 1 across Burrard Inlet at the Second Narrows location (if it is not already required). The Indian Arm/Indian River option will lead to an early requirement for increased capacity on Highway 1 from Stormont to First Avenue (if it is not already required), and connections south to Highways 91 and 99.

3.4 Environmental Review Processes

Any of the alternative routes from Vancouver to Squamish will require that formal environmental review processes be undertaken in accordance with the B.C. Environmental Assessment Act (BCEAA) and the Canadian Environmental Assessment Act (CEAA). This means that at least two years is required to undertake such a process before any work can commence, and at a cost of approximately $2 to $5 Million for a project of this scope. Upgrading an existing route may be on the lower end of this scale, while a new route will be on the higher end (the Indian Arm/Indian River route in particular).

Further delay can be expected, as re-design is required to respond to review requirements, stakeholder and public consultations, etc. First Nations review and involvement, in particular, could lead to significant project delays. In addition, there will be costs for any additional detailed environmental, fisheries, wildlife, noise and archaeological studies which add 5-10% to the normal construction costs.

ROUTE COMPARISON SUMMARY

COST and IMPACT FACTORS 1 = least preferable to 5 = most preferable	ROUTE OPTIONS				
	Highway 99 North upgrade	Capilano River	Seymour River	Indian Arm /Indian River	Hybrid Seymour-Indian River
FINANCIAL ACCOUNT					
• Capital cost					
- route cost	5	3	1	1	2
- link to Provincial network	5	3	3	1	3
- network upgrade cost	4	4	4	2	4
• Added operating/maintenance cost	5	4	3	1	4
• Traffic disruption cost	1	4	5	4	5
CUSTOMER SERVICE ACCOUNT					
• User travel time reduction	3	5	5	2	5
• System integration	3	3	3	5	3
• Mode shift potential	5	3	3	1	3
• Timing of benefits	5	1	1	1	1
• Vehicle operating cost reduction	5	4	3	3	3
• Accident cost reduction	5	5	5	5	5
ECONOMIC DEVELOPMENT ACCOUNT					
• developable land accessed	5	3	1	1	1
• interior interaction	2	2	2	2	2
• generated travel	3	3	3	5	3
SOCIAL ACCOUNT					
• urban land use impact	3	3	3	2	3
• park/recreation impact	4	4	3	1	3
• First Nations impact	4	4	3	1	3
• consistency with regional growth plans	5	3	3	1	3
• emergency route	1	2	3	5	4
ENVIRONMENTAL ACCOUNT					
• watershed impact	5	1	1	3	3
• geotechnical concern	3	5	1	1	1
• physical env. impact	3	2	2	1	2
• avalanche concern	5	4	2	1	1
• archaeology	5	3	2	1	2
TOTAL	**94**	**78**	**65**	**51**	**69**

3.5 Maintenance and Operational Cost Comparison

The additional annual road and bridge maintenance costs, as well as the ongoing annual costs for additional activities such as an active snow avalanche control program or the rock slope stabilization program will vary for the different alternative routes. The following table compares the annual maintenance and operational costs between the four routes:

	new hwy. ln-km	cost per ln-km	new hwy. maint. cost	new sq m bridges	costs/ sq m	new bridge maint. cost	avalanche program	rock stab. program	total added maint/ops costs
Highway 99 Route	212	$9,000	$1,908,000	16,210	$21.9	$355,000	$0	$100,000	$ 2.3 Million
Capilano Route	265.4	$9,000	$2,388,600	34,014	$21.9	$744,900	$160,000	$50,000	$ 3.3 Million
Seymour Route	265	$9,000	$2,385,000	79,162	$21.9	$1,733,600	$235,000	$50,000	$ 4.4 Million
Indian Arm Route	300	$9,000	$2,700,000	198,464	$21.9	$4,346,400	$250,000	$50,000	$ 7.3 Million
Hybrid Seymour – Indian River Route	258	$9,000	$2,322,000	75,690	$21.9	$1,657,611	$250,000	$50,000	$4.3 Million

Notes: 1. For the existing route we have used only the additional lane-kilometres, etc. between Fern Street Interchange and Squamish (Mamquam Interchange), not the current inventory.

2. Capital investment costs for an active avalanche program are approximately $1.6 Million for Capilano, $2.2 Million for Seymour, and $2.8 Million for Indian Arm/Indian River.

There are also operation difficulties that will have to be overcome in loading out all snow and ice during winter maintenance, then hauling it to an acceptable disposal location. During times of very high snowfall rate it will not be possible to keep up, and one lane in each direction would be lost to snow storage until the snow could be loaded to trucks for hauling.

3.6 Private Sector Involvement and Route Tolls

It should be noted that any of the alternative routes from Vancouver to Squamish could be delivered as a Private sector partnership, where the route would be available to the successful proponent to operate for a number of years as a toll facility. This would not only dramatically reduce the cost of any of these routes to the Province, but could potentially deliver them at no cost if sufficient revenue is foreseen.

4. Sensitivities and Issues

The following section deals with a number of sensitivities or issues that would become of paramount importance should another option than the existing Highway 99 corridor be selected, as well as for the remainder of the route. These are significant cost drivers, and in some cases could be "show-stoppers" regarding general public or First Nations' acceptance.

4.1 Highway Engineering

4.1.1 Vancouver to Squamish Optional Routes

- Highway 99 upgrading option

  - ◊ in order to compare to the Capilano and Seymour options we have included upgrading requirements from the Fern Street Interchange to Horseshoe Bay on Highway 1. This has been assumed to include interchange improvements to a number of interchanges, and the addition of lanes (to six lanes) from the Fern Street Interchange near the Ironworkers Memorial Bridge (Second Narrows), to the Taylor Way Interchange north of the Lions Gate Bridge (First Narrows).
  - ◊ costs can be significantly reduced for the initial tunnel near the Caulfield Interchange if the consultant's previous solution is modified to a two lane tunnel for northbound traffic, while the southbound traffic remains on an upgraded alignment of the existing highway. This approach is also suggested for a number of locations to the north, and this will significantly reduce the upgrading costs.
  - ◊ a significant issue which affects construction costs and scheduling is that of traffic management. There must be accommodation of existing traffic as far as is possible, and any delays must be minimized. No restrictions or delays will be acceptable during weekends or certain times of the year.
  - ◊ access control and interchange design will be a challenge. This report proposes that the existing interchanges at Lion's Bay and Furry Creek be upgraded, as well as the interchange under construction at Sunset Beach. Furthermore, three new interchanges would be provided at Porteau Cove, Britannia Beach and Shannon Falls. The topographic features on this corridor are such that it is physically impractical or economically unwarranted to upgrade all the other accesses, so right-in, right-out access is suggested for most. For some infrequent uses it may be acceptable to allow controlled (gated) at grade access. There must also be adequate allowance for roadside pullouts and access to viewpoints or rest areas along the corridor.
  - ◊ there will be a high cost associated with a 90 km/h design through the Kelvin Grove and Lions Bay areas due to property acquisition. An option to reduce the design and posted speeds to 80 km/h should be reviewed at detailed design.
  - ◊ this report assumes that 2.5 metre paved shoulders will accommodate cyclists, while the previous consultants recommended a separate west side cycle path on the Highway 99 upgrade option. This should be reviewed further in detailed design.
  - ◊ There must be caution emphasized for interim upgrading of Highway 99 between Horseshoe Bay and Squamish, similar to that discussed in Section 2.3 regarding the highway between Squamish and Whistler.

Highway safety must be paramount, and any passing lane additions must carefully consider the speeding behaviour this may promote, and the traffic safety hazards left in areas with advisory warning for reduced curve speeds.

- Alternate routes

The alignments provided by previous reports for the alternate routes have been reproduced onto the 1:20,000 scale TRIM mapping. The alignments and grades have then been optimized to try to follow the least rugged terrain or avoid environmental or geotechnical concerns where possible, using 90 km/h design speed. The final alignment reflects best engineering judgement at this level of mapping accuracy, as well as the discussions with the other disciplines (geotechnical, environment, avalanche etc.). Some of the major changes in the alignment included:

- ◊ Go through the Balfour Valley as opposed to Loch Lomond on the Seymour alignment
- ◊ Go around the "slump or slough" area at the end of the Capilano alignment
- ◊ Move the Indian River alignment to one side or the other of the Indian River to avoid environmental and maintenance concerns
- ◊ Shift the Indian Arm alignment lower down toward the power line along Buntzen Lake and Indian Arm in order to lessen a steep side slope cut

There were other areas where comments have been made on the alignment plots showing issues that would have to be dealt with at the detailed design stage, for instance:

- ◊ Try to avoid the cemetery and the unstable side slope on the common section of the Capilano and Seymour alignments from Fern Street up through the Seymour demonstration forest area.
- ◊ Try to avoid through cuts where potential debris flow creeks cross the highway alignment.

Other notable issues include:

- ◊ there are lengthy tunnels required at the summit of the Indian River and Seymour alternate routes in order to obtain acceptable grades.
- ◊ the advantages of the alternate routes is primarily a logistics one in that there will be no existing traffic to complicate traffic management and project scheduling, construction traffic safety issues, etc.
- ◊ proximity to the gas pipeline in the Stawamus watershed, affecting both the Seymour and Indian Arm/Indian River options, will raise costs due to crossings and additional stabilization measures.
- ◊ the terminus interchange with Highway 99 in Squamish for the alternate routes from the Seymour or Indian Arm/Indian River options has been proposed on the north side of the Mamquam River, necessitating a new bridge crossing and a new interchange.
- ◊ on the Seymour route alternative, we have followed the Balfour Creek Valley from the upper Seymour River, rather than follow the Seymour River to the summit, due to the improved alignment and the lesser number of natural hazards this provides.

4.1.2 Squamish to Whistler

This section of Highway 99 currently has portions of two, three and four-lane cross-section. Two upgrading options have been cost estimated; a four-lane expressway standard, and a three-lane cross-section of alternating passing lanes.
In both cases the alignment follows the existing highway, except in the Garibaldi Civil Defense Zone, where a re-alignment was made to move the highway to the west side of the Cheakamus River and out of the high-risk area of the Zone.

For Urban Squamish, upgrading to replace all five existing signals on Highway 99 with grade-separated interchanges has been cost estimated. Benefits include:

- collapsing the current five signalized intersections, from Clark Drive in the south to Garibladi Way in the north, to three grade-separated interchanges, and connecting the previous via a frontage road system.
- at Clark Drive in particular, a frontage road south to Stawamus I.R. 24 will avoid the need for another interchange at Valley Drive and potentially resolve the long-standing dispute regarding Highway 99 right-of-way. The frontage road must also access Squamish City Centre via a new bridge across the Mamquam Blind Channel connected to Hunter Drive, and this will eliminate the need for an interchange at Cleveland Avenue.
- travel times will significantly improve through Squamish, and traffic throughput will increase enough to avoid the need to add additional lanes to the highway through Squamish for many years.
- the Indian Arm/Indian River or Seymour option would tie back into Highway 99 just north of the Mamquam River at a new Interchange, and this would also involve a new bridge crossing of the river.

For Urban Whistler, we have recommended a two-stage approach;

- the existing Highway 99 alignment be improved to a facility with 70 km/h design and posted speed throughout. This would include access (controlled access) and minor alignment improvements as this section is currently posted at 60 km/h. In addition, we are recommending three-lane cross-section with two continuous southbound lanes from just south of Function Junction to Lorimer Road, and a two-lane cross-section beyond. The community of Whistler has supported this in their Official Community Plan.

- A complementary two-lane facility should be planned, and the corridor properties be acquired, for a route along the west slope of the valley connecting on the south at Sproatt (before the B.C. Rail crossing), just south of Function Junction, and on the north at Green Lake. This will serve as a by-pass for Highway 99 in future and will also help disperse some of the Whistler community traffic. This route follows the alignment laid out by Delcan for the community of Whistler in 1998, and for which the right-of-way is partially protected.

4.1.3 Whistler to Pemberton

The alignment at Suicide Hill has been improved and this also removes a level rail crossing. Horizontal and vertical alignments have been developed for this area using 1:20,000 scale TRIM mapping. Cost estimates were produced with

quantities extracted from a digital terrain model using the TRIM mapping and entering the quantities into the 'Wolski' cost estimating spreadsheets.

4.1.4 Pemberton to Lillooet

A potential by-pass of the Mount Currie main reserves has been plotted, and is shown as a dotted line on the mapping.

The ascent to Duffey Lake from the Pemberton Valley requires a new and longer approach in order to improve the grades. The descent from the Duffey Lake route to Seton Lake near Lillooet requires tunneling and heavy cuts to ease the grades.

Horizontal and vertical alignments have been developed for these areas using 1:20,000 scale TRIM mapping. Cost estimates were produced with quantities extracted from a digital terrain model using the TRIM mapping and entering the quantities into the 'Wolski' cost estimating spreadsheets.

4.1.5 Lillooet to Highway 97

Highway 99 has been re-aligned at the Fountain Valley Slide area, and this also addresses the rail crossing. Horizontal and vertical alignments have been developed for this area using 1:20,000 scale TRIM mapping. Cost estimates were produced with quantities extracted from a digital terrain model using the TRIM mapping and entering the quantities into the 'Wolski' cost estimating spreadsheets.

4.2 Geotechnical

4.2.1 Vancouver to Squamish Optional Routes

- rock cuts

It should be noted that we have attempted to minimize the volume of rock cut excavation required, and resultant costs, which will also reduce the height of the cuts and hopefully minimize future rock slope stabilization program requirements. Previous studies assumed that all lanes of the new corridor on the Indian Arm route, and the upgraded Highway 99 route, would be at the same elevation or cross-section. This increased the volume of rock to be excavated very considerably over the approach we have assumed, which is to separate the elevations of northbound and southbound lanes (split grade).

Previous studies also used old specifications for ditch widths for rock cuts greater than 16 metres. New ditch design will call for wider ditches and an offsetting increase in rock volumes and costs.

The functional design recommends twin two-lane tunnels to avoid rock fall hazards at several locations. In some cases the existing Highway 99 alignment can be used for the southbound lanes of the new four-lane facility, significantly reducing costs of tunneling.

At Porteau Bluffs, Piteau Associates recommended excavating to the joint angles at ~45 degrees, which may involve setbacks or takings from the current Golf Course development. However steeper slopes can be achieved with extensive on-slope stabilization. This would enable use of the existing alignment with improvements for southbound traffic as an option to the proposed tunnel. Cost of a two-lane southbound tunnel at Porteau Bluffs is

estimated at $40 Million. Cost of improvements to the existing two-lane alignment to accommodate southbound traffic is expected to be less than one quarter the tunnel cost.

- debris flows

  The debris flow hazards have been identified in previous consultant work, but the cost of structures required to protect the highway from them was not adequately addressed for the alternate routes.

  For the existing Highway 99 upgrade option, the suggested debris basin treatments may be more elaborate than necessary. We recommend clear-spanning the channels wherever possible, perhaps with bottomless steel arch structures or bridges, rather than constructing elaborate basins and channel flumes.

- landslide areas

  On the north side of Furry Creek, approximately 250 metres east of Highway 99, there is a large existing landslide area of ~500,000 cubic metres. The Capilano alignment per this report avoids this area entirely.

  There remains potential for large events in the area of Loggers Creek Slide and at M Creek. While tunnels have been proposed in the Klohn report, which would pass behind both, it may be possible to use the highway for southbound lanes. If this is done, the Loggers Creek Slide would require remediation and care would have to be taken to ensure the structure crossing M Creek was re-built with sufficient clearance beneath to accommodate the design volume of a potential failure.

- aggregate supply

  Potential gravel deposits on the Capilano and Seymour routes is considered poor to moderate, with the exception of possible granular materials on Furry Creek at the north end of the Capilano route and at the confluence of Eastcap Creek with Capilano River. 70% or more of the aggregates that will be needed for construction will have to be imported with haul distances in excess of 20 kilometres, or will have to be crushed at quarries developed along the routes.

  Gravel deposits are probable along the Indian River, however these are likely to be of poor quality north of Meslilloet Creek and into the Stawamus River area for both aggregates and quarried rock. This will lead to long haul distances to the summit area. It should also be noted that removal of gravel from braided sections of the valley might be difficult and/or costly, as these areas will have very high environmental values.

  For the existing Highway 99 upgrade, Klohn suggested barging aggregates in for the project, but disposing of surplus rock into Howe Sound. We recommend crushing the rock on site for the aggregate requirements, including for future aggregate needs for the corridor if sufficient surplus rock exists from the rock cut excavations. Costs can be saved both from aggregate supply, and disposal of surplus rock.

4.2.2 Squamish to Whistler

- rock cuts

  From Culliton Creek to Callaghan Creek virtually all cuts will be in rock.

- landslide areas

  Cheakamus Canyon has a 50,000 cubic metre rock mass remaining following the 1995 slide of similar volume. As the alignment cannot be moved enough to avoid this hazard, excavation will be required and this is estimated to cost more than $1 Million.

  The Cheekeye River has a history of debris torrents, with the most recent occurring in the 1920's and 1958. The existing structure may not have sufficient clearance beneath to accommodate an event of the magnitude of either of the most recent failures.

  The Garibaldi Civil Defense Zone, created due to the hazard posed by the "Barrier", involves a realignment of Highway 99 to the west side of the Cheakamus River to skirt most of the high hazard area. While the last major failure was in the 1850's, the hazard and risk is significant. In the early 1970's the Province bought out all the residential properties and dismantled or moved all permanent dwellings from the Zone.

- aggregate supply

  The main source of aggregate supply is the Ministry's Callaghan Creek Pit. Materials will be suitable for bases but may be a problem for paving due to the content of basaltic rock.

4.2.3 Whistler to Pemberton

- rock fall

  The "Suicide Hill" area will require wide catchment ditches and roadside barrier, as this area is prone to rock fall. Stabilization of the rock slopes above Green Lake will also be necessary.

4.2.4 Pemberton to Lillooet

- rock fall

  The bedrock in the Seton Lake area will yield unstable rock slopes after excavation, and these will require wide catchment ditches with roadside barrier to prevent "bounce" onto traveled lanes. Tunneling costs will also be higher due to the less competent bedrock. Ongoing rock slope stabilization costs will be high. Loose talus slopes are also prevalent, which will increase costs due to retaining walls and other protective measures.

- debris flows and flooding

  At least one debris flow fan is apparent in the Duffey Lake area, and flooding along Cayoose Creek is evident. The latter will require raising the road grade and providing bank protection in a number of locations.

- landslide areas

Retaining walls will be needed in a number of locations along Duffey Lake as current shoulder embankments are unstable.

4.2.5 Lillooet to Highway 97

- rock fall

  A number of high slopes on the east side of the Fraser River have a history of rock fall. The most severe slope is the "Shooting Gallery" where protective structures, such as a high-energy net fence, are required. This would cost approximately $750,000 in this location alone. Other areas can be protected with widened catchment ditches.

- landslide areas

  The Fountain Slide (10-Mile Slide) is on the east side of the Fraser River, and is about 300 metres wide and extends a kilometre or more up slope from the river level. Both B.C. Rail and Highway 99 cross the slide and both are experiencing ongoing maintenance issues. As there is no way to avoid crossing the slide there will be ongoing costs to deal with slow movement and settlement.

- aggregate supply

  Gravel sources are good along the Fraser River but poor at the Highway 97 end of this section. The latter may increase costs due to haul distances.

4.3 Environmental

4.3.1 Vancouver to Squamish Optional Routes

- water supply watersheds

  The Capilano, Seymour and Indian Arm/Indian River options all involve traversing a community water supply watershed (the upper Stawamus river watershed in the case of the Indian Arm/Indian River option).

  In 1999, the Office of the Auditor General produced a report on *Protecting Drinking-Water Sources* and recommended that "The Province give priority to planning and building transportation routes and infrastructure in ways that will prevent the degradation of drinking water sources." (p.90). Also, the report states "...the transportation of materials and people contributes minor spills of pollutants that ultimately find their way into adjacent water bodies...Individually, each spill is seldom noticeable, but the cumulative impacts can destroy drinking-water sources." (p.86). We have taken this to infer that total run-off containment on the highway would be necessary. This would be a VERY costly proposition, but we have used this assumption in our cost estimates and included the following treatments through community watershed areas:

  - ◊ asphalt curb and catch basin treatment throughout.
  - ◊ holding or containment ponds (wetland-type areas) for a minimum 72 hour retention. These would be VERY large.
  - ◊ snow and ice, and spent winter abrasives, would all have to be picked up and hauled away to disposal. Alternatively storage of these on the

right-of-way would require paving or treating the area to prevent groundwater "leaching", and meltwater or leachate drainage catchment and holding or containment as above.

- ◊ Exclusion fence throughout to prevent or prohibit people from entering the watershed (this could also serve to prevent wildlife from entering the highway right-of-way. Wildlife underpasses would be needed about every two kilometres.
- ◊ A proactive response plan, and possibly stand-by equipment, would be necessary for hazardous spills and emergencies.

Even with the extraordinary measures of total containment of run-off as described above, public reaction and opinion to a 4-lane highway may be a "show-stopper". At the very least, a great deal of positive public relations would be necessary as this would be the subject of great emotional public debate, and extensive environmental review and approvals through a long and difficult process. It is would not be possible to give absolute assurances of no impact, given airborne contaminants from the operation of motor vehicles and the possibility of vehicle accidents that may include fires.

The Greater Vancouver Regional District (GVRD) is not planning any abandonment of the Capilano watershed for water supply, but may be planning on further filtration (via a diversion to Seymour where a filtration plant is to be installed). The latter may assist somewhat in a case for a highway through the watershed, but probably not much.

- fish bearing streams

All the alternate routes follow major fish-bearing streams, which was not stressed by the previous consultant work. Construction will involve short fisheries "windows" and will affect costs. Wherever possible a 50 metre "buffer" should be maintained from all water courses, and all culverts should be oversized to ensure fish passage.

The estuary of the Indian River is an extremely valuable environmental area. Mitigation may be in the order of $25 Million.

- parks

As a potential "show-stopper" the Indian Arm route would go through Indian Arm Park, which is now designated as part of the Lower Mainland Nature Legacy and is a Class A park. This will be a very sensitive issue with the public (there is a very strong lobby group) and a matter requiring extraordinary public relations.

- archaeology

The alternative routes will have areas of concern for potential archaeological sites, especially crossing Burrard Inlet, at the Indian River estuary, and in the Indian River valley. This may cost as much as $5 Million for mitigation/compensation. The Capilano or Seymour options may cost as much as $2 Million for archaeological mitigation/compensation.

- wildlife

The Indian Arm/Indian River, Seymour and Capilano options all pass through areas of moderate to high wildlife values. 30-50% of these routes may require wildlife fencing on both sides of the highway, and wildlife underpasses at 2 km intervals.

- spotted owls

  Within the drainage areas traversed by the alternate routes there are many protected areas for spotted owl habitat. These would require special approval and/or mitigation, and this extends to any areas where gravel extractions were to occur.

- acid rock drainage

  Mineralization in the Gambier Group (the rock formation present at Britannia Creek drainage area) has resulted in one of the most serious acid drainage problems in B.C. The same formation is present in the upper Indian River watershed and the Stawamus River watershed. Opening rock cuts to weathering could result in creation of a serious and costly environmental problem such as has occurred at Pennask Creek on Coquihalla, Phase 3.

- Britannia Beach

  At Britannia Beach the waterfront area consists of soft sediments deposited from mining activity, and these display slump features. If disturbed, high concentrations of copper and other contaminants are likely to be released. The waterfront area, and any relocation of the BC Rail line, should be avoided if at all possible.

- Howe Sound

  The 1992 Klohn report suggested disposal of excess rock, and rock "muck", directly into Howe Sound. It is unlikely that approval for such a scheme would be acceptable today, or the approval process to undertake this would be very onerous. We believe it is more prudent to reduce rock volumes by split grades, etc. and otherwise plan to use the material for terrestrial fill, or to haul it to terrestrial disposal.

- Movement of Hazardous Goods

  Since all the alternative route options from Vancouver to Squamish involve some lengthy tunnels, it may be advisable to restrict the movement of hazardous goods to Highway 99 itself. If Highway 99 is upgraded as the option this would also involve some lengthy tunnels, and may require that hazardous goods be transported to Squamish by marine transportation in future.

- Ornamental Landscaping

  Urban sections of any of the alternative routes will require special landscaping beyond normal highway treatment.

4.3.2 Squamish to Whistler

In general this route does not present significant environmental issues that cannot be mitigated and/or compensated.

There are at least 13 new stream crossings involved in the Whistler by-pass, and most are considered fish bearing. Mitigation will be required near wetlands in several locations.

4.3.3 Whistler to Pemberton

In general this route does not present significant environmental issues that cannot be mitigated and/or compensated.

4.3.4 Pemberton to Lillooet

There are several areas with potential archaeology sites around the Pemberton/Mount Currie and in the river valley sections. The 1987 Reid Crowther study suggests that there are at least 55 known archaeological sites near the route, and recent archaeological work was undertaken at the Birkenhead River Bridge project. It is estimated that at least $5 Million is required for archaeological work.

At the Mount Currie Reserve a buffer of 50-100 metres (the latter being the most preferable) should be retained along the Lillooet River. Agricultural Land Reserve (ALR) lands are impacted in the floodplain as well. Fills may need to be minimized with walls in many locations, and care/attention will need to be taken to compensation/mitigation for habitat disruption.

The route passes through an area with moderate to high wildlife values. Some wildlife fencing and wildlife reflectors will be required.

The re-alignment at the Seton Lake end of this section will require 50-100 metre buffer zones adjacent to the salmon spawning channels at Cayoosh Creek and Seton River.

4.3.5 Lillooet to Highway 97

There are no unusual or particularly significant environmental issues for this section of Highway 99.

4.4 Snow Avalanche and Highway Operations

4.4.1 Vancouver to Squamish Optional Routes

Within this study it was assumed that snow avalanches should be managed at a similar standard to the Coquihalla avalanche control program (road closures restricted to extreme events, and only minor delays for avalanche control during normal winter operations). Therefore if it was feasible to mitigate an avalanche hazard with a static defense structure, snow shed or highway re-alignment the most suitable method was recommended. Previous studies may have indicated a fewer number of structures, however road closure for avalanches and avalanche control would be higher and the potential risk to the travelling public greater. In addition to these structures an active avalanche control program will be required. No capital costs have been estimated for the establishment of this program.

Most avalanches along the corridors between Vancouver and Squamish will be direct action avalanches and will occur during or immediately following storms.

Persistent deep snow pack instabilities, which result in dry slab avalanches, will be uncommon.

The area has a maritime climate throughout. Precipitation amounts are very high with the highest recorded amounts being found in the Loch Lomond area (775 cm snow pack recorded at 900 m asl in 1946). Temperatures throughout the area are moderate. Previous studies found that it would be reasonable to expect that a five-day storm will bring in excess of 300 mm of precipitation once every ten years.

It should also be expected that there will be occasional road closures due to rock fall incidents. While there will be an active rock stabilization program for any of these routes and initial design, construction and slope protection will minimize the hazards, the risk of rock fall cannot be eliminated for any of these routes. Winter rock fall patrols may be necessary as well.

- for the Capilano Option, it will be feasible to manage the avalanche hazards at a standard that is similar to the Coquihalla. Next to the Highway 99 option, the Capilano option is the least avalanche prone:

    - ◊ 49 avalanche paths, of which 26 could directly affect the proposed alignment, however with adjustments to the alignment the majority could be avoided, or the hazard could be significantly reduced.
    - ◊ 6 sites require static defense structures, and one site requires a snow shed of approximately 100 metres length.

- for the Seymour option, it would be difficult and costly to achieve a standard similar to the Coquihalla. Managing the hazard in this area will require an aggressive approach to active avalanche control measures. This would involve the use of such methods as artillery or Gaz.Ex and will result in more frequent road closures:

    - ◊ 96 avalanche paths, of which 39 could directly affect the proposed alignment, however with adjustments and construction of static defense structures the avalanche hazards could be significantly reduced.
    - ◊ 15 of these paths will require static defense structures (for a cost of about $750,000). One area could be mitigated with snow sheds (about 1,100 metres in length for about $71.5 Million), but this is not recommended as the hazard does not warrant the cost. This area would be better managed with the installation of permanent avalanche control devices such as Gaz.Ex.

- for the Indian Arm/Indian River option, it will also be difficult and costly to achieve a standard similar to the Coquihalla. Similar to the Seymour corridor a more aggressive approach to active avalanche control measures will be required. Such methods as artillery or Gaz.Ex will be required:

    - ◊ 82 avalanche paths within the corridor, of which 41 could directly affect the proposed alignment, however with adjustments to the alignment and construction of static defense structures the majority could be avoided or the hazard could be significantly reduced.
    - ◊ the summit area alignment crosses 12 avalanche paths on the northeast side of the valley, which requires the alignment to be moved down slope to the toe of the paths. If this is cannot be done a continuous snow shed of up to 2,000 metres length is required, but is not recommended,

as the hazard does not warrant the cost. This would cost approximately $143 Million otherwise.

- ◊ In addition, 13 sites will require static defense structures, and 3 sites will require snow sheds to an approximate length of 350 metres.
- ◊ Similar to the Seymour corridor there are a number of sites which will require the installation of permanent avalanche control devices such as Gaz.Ex to effectively manage the hazard within the corridor.

- for the Highway 99 option, there are no significant snow avalanche hazards or activity at the highway elevation.

- there will have to be consideration of, and a strategy for, the movement of dangerous goods through the lengthy tunnels on all alternative options and/or the existing Highway 99 corridor should this be upgraded.

4.4.2 Squamish to Pemberton

There are no significant snow avalanche hazards or activity over this section of Highway 99 that cannot be avoided with minor alignment adjustment or enlarged ditch catchment.

4.4.3 Pemberton to Lillooet

- there have been 114 avalanche paths identified, and 84 of these could pose a potential hazard to the highway.

- the entire area is considered to have a moderate hazard index rating and is managed with an active avalanche control program.

- approximately 40 sites can be avoided by modest alignment revision.

- 11 sites will require static defense structures (about $550,000), 3 sites will require snow sheds to a total length of 410 metres (about $14.3 Million), and 14 sites require enlarged catchment.

- these changes will significantly reduce the hazard, annual operational costs and road closures.

4.4.4 Lillooet to Highway 97

There are two avalanche areas; at the "Shooting Gallery" (about 5 km north of Lillooet), and at Marble Canyon. Widened ditches or catchment areas are sufficient to address the hazard presented by these low frequency, low hazard sites.

4.5 Structures

4.5.1 Vancouver to Squamish Optional Routes

Based on more recent experience from the Vancouver Island Highway Project, the requirements for clear spanning of creeks and rivers will be greater than the previous studies had indicated. This will affect both the length of bridge spans and

the number of bridge structures. The latter is the result of the preclusion of culverts in many instances.

Cost estimating was performed using the quantities and unit rates from the most recent consultant report, then inflating the unit rates to $2,000 per square metre of total deck area. Although the scope of this report did not allow for any hydrological analysis, the production of better mapping as well as a road profiles provided a better understanding of the topography than available for the original 1989 Hamilton report. Structures were added for some named creeks where none had been indicated in previous reports. The higher quality of the base work done on the Indian Arm/Indian River segment (Klohn Crippen, 1991) and the Caulfield to Furry Creek segment (Klohn Crippen, 1992) should result in a greater degree of accuracy in this report than for the Capilano or Seymour segments.

Bridge widening for all existing bridges has been cost estimated at the same rate ($2,000 per square metre) as new bridge construction. Seismic retrofits to existing bridges have been estimated at 20% of replacement cost for the original structure, and this was applied to all existing structures on the route which are not to current seismic standards.

4.5.2 Squamish to Whistler

For this section a new bridge crossing of the Cheakamus River was added at the change of alignment in the Garibaldi Civil Defense Zone. For the three bridges remaining on the old alignment it was assumed that they would be devolved to B.C. Hydro, and no retrofitting or widening costs were added. New structures were also added at level rail crossings, alignment changes, and for structures where deterioration has already progressed to a point where widening is not appropriate.

4.5.3 Whistler to Pemberton

New structures were added at level rail crossings, alignment changes, and for structures where deterioration has already progressed to a point where widening is not appropriate.

4.5.4 Pemberton to Lillooet

New structures were added at level rail crossings, alignment changes, and for structures where deterioration has already progressed to a point where widening is not appropriate.

4.5.5 Lillooet to Highway 97

New structures were added at level rail crossings, alignment changes, and for structures where deterioration has already progressed to a point where widening is not appropriate.

4.6 First Nations

4.6.1 Vancouver to Squamish Optional Routes

- Tsleil Waututh Nation

The Tsleil Waututh First Nation (ex-Burrard Indian Band) is currently in the Treaty Process and has outlined their interest area. They have also produced

a report to the Treaty Table entitled 'A Future for the People of the Inlet' outlining their issues, concerns and desires for resolution. Although their main reserve currently is located in North Vancouver off the Dollarton Highway (Burrard Inlet I.R. #3) and their interests for community expansion (Treaty Settlement Lands) is primarily adjacent to this area, their other interests include the following:

a) Affecting the Indian Arm/Indian River alternate route...

- Lower Indian River area
  ..."wilderness expansion land", or potential Treaty Settlement Land for eco-tourism, eco-forestry, traditional salmon fishing, wildcrafting centre, trail network, and related cultural and economic uses
  ...this area is adjacent to (north of) the Inlailawatash I.R. #4 near the mouth of the Indian River, and within or adjacent to the Indian Arm Provincial Park (to the south, and bordering the northern end of Indian Arm).
- Upper Indian River area
  ..."wilderness expansion land" for eco-tourism, eco-forestry, trail network, and related cultural and economic uses
- Indian River headwaters area
  ...the Tseil Waututh wish this area to be protected for spiritual, cultural and ceremonial uses, with potential eco-tourism
- Buntzen Lake Recreation Area
  ...currently managed by BC Hydro, but the Tseil Waututh wish co-management of this area.
- Indian Arm (Say Nuth Khaw Yum) Provincial Park
  ...the Tseil Waututh wish co-management of this area.

b) Affecting the Seymour River alternative route

- Lower Seymour Conservation Area
  ...currently administered by the Greater Vancouver Water District; and "the Tseil Waututh wish co-management of this area.

Due to the special interests the Tseil Waututh have in utilizing current wilderness areas for eco-tourism and cultural/spiritual uses there is expected to be significant opposition to a major highway route through these areas. At the least there will be a requirement for access restriction to adjacent lands, and a thorough environmental review and mitigation regime.

As the Tsleil Waututh wish to co-manage the land base in these areas they would have to be partners in any project involving a highway and access into the area. It is expected that there would have to be accompanying Interim Measures funding or other agreements that would involve cost to the project as part of any understandings or agreements for such a highway. We have added $4,000,000 to the Indian Arm/Indian River route and $1,000,000 to the Seymour route for this purpose, but such costs are very, very rough and may not be direct costs to a highway project.

- Squamish First Nation

The Squamish First Nation (SFN) are not actively in Treaty process at present, but there is extensive ongoing discussion and consultation with them regarding a number of outstanding issues. It is expected there will be considerable

interest in any of the alternate routes from Vancouver to Squamish, or for upgrading of Highway 99 itself.

For either the Capilano option, or the upgrading of Highway 99, there must be resolution and agreement regarding the status of Highway 99 through Stawamus I.R. #24 at Squamish. The right-of-way at this location is currently only Section 4, and is under dispute. The recommended upgrading at this location includes a full interchange at Clark Drive to the north, a connecting frontage road to I.R. #24, and a pedestrian overpass at Valley Drive. These improvements will go a long way toward resolving Highway status as they have been requested by SFN. An option is currently being considered (and discussed with the Squamish First Nation) which would add a signal at Valley Drive, but this is not recommended. A signal at this location will not conform to the grade-separated standard per this report.

It is believed that the Squamish First Nation have a preference for the Province to pursue the Capilano option rather than upgrade Highway 99. This option would impact less on them should they relocate the Stawamus Reserve (I.R. #24) to Porteau Cove from its present location at the south end of Squamish. It should be noted, however that upgrading of Highway 99 had been proposed in addition to Highway 99 upgrading, so the only real possibility is to limit upgrading in the Porteau vicinity should a Capilano route option proceed.

It is expected that there would have to be accompanying Interim Measures funding or other agreements that would involve cost to the project as part of any understandings or agreements for highway improvements. We have added $1,000,000 to the Highway 99 and Capilano options for Highway 99 impacts south of Squamish (primarily at I.R. #24), and $1,000,000 to the Indian Arm/Indian River and Seymour options for impacts in the Stawamus River watershed, for this purpose. Such costs are very, very rough and may not be direct costs to a highway project.

4.6.2 Squamish to Whistler

There are not expected to be any direct impacts to First Nations over this section of Highway 99, however archaeological investigation will be required in a number of locations.

4.6.3 Whistler to Pemberton

- Lil'wat Nation (Mount Currie Band)

The Mount Currie Band (Lil'wat Nation) is a member of the Stl'at'imx Nation and the Lillooet Tribal Council. They are not in the Treaty process, so there is only discussion or ongoing dialogue with them regarding specific projects in their area or on their reserves, or as part of ongoing maintenance operation for the highway.

- In-SHUCK-ch/N'Quatqua

The In-Shuck-ch/N'Quat'qua are in the Treaty process, but the N'Quat'qua have "broken off". The In-Shuck-ch interest area for Treaty Settlement Lands (TSL) is well south of Pemberton, from Lillooet Lake to Harrison Lake where their communities are located. The N'Quat'qua TSL interest areas are near D'Arcy on Anderson Lake and in the Birkenhead Lake area. Neither are likely

to perceive direct impacts due to upgrading of Highway 99, but consultation and involvement is recommended due to their broader aboriginal interest area.

4.6.4 Pemberton to Lillooet

- Lil'wat Nation (Mount Currie Band)

  There is concern of the existing right-of-way status through Mount Currie I.R. #8 and #3, between kilometres 7.5 and 15.5 (from the junction at Pemberton), where previous disputes led to blockades of Highway 99 for months on end.

  The alignment proposed bypasses the present route, but follows the Lillooet River dyke and goes through I.R. #1, #8 and #3. As this may also not be acceptable, we have shown an alternative alignment (**dashed line**) that crosses the Birkenhead River near Mount Currie and follows the River's north shore within I.R. #6 where the impacts would be less (but the costs would be higher). The latter has not been cost-estimated.

  There is no way to traverse the Pemberton Valley without traversing one or more of the Mount Currie Reserves.

  It is expected that there would have to be accompanying Interim Measures funding or other agreements that would involve cost to the project as part of any understandings or agreements for highway improvements. We have added $3,000,000 for this purpose, but such costs are very, very rough and may not be direct costs to a highway project.

- In-SHUCK-ch/N'Quat'qua

  The In-SHUCK-ch/N'Quat'qua were in the Treaty process, but N'Quatqua have "broken off", so things are in abeyance at present. Most of the In-SHUCH-ch interests are south of the Pemberton area, in the Lillooet Lake to Harrison Lake valley. The N'Quat'qua interests are in the D'Arcy area on Anderson Lake and near Birkenhead Lake. It is not expected that there are any direct impacts to the In-SHUCK-ch/N'Quat'qua from Highway 99 upgrading.

- Cayoose Creek Band

  The Cayoose Band is a member of Stl'atl'imx Nation and Lillooet Tribal Council, but is not in Treaty process. The only communications with the Band are through the Area Manager locally.

  At Cayoose Reserve #1 there is a current trespass at Shantyman corner, and the tangent from the creek to the corner is an issue with the Band. The Ministry has a temporary Bailey Bridge and has been attempting to get approval to replace it with a two-lane permanent structure. There are two side roads (Texas Creek Road and Powerhouse Road) with poor intersection geometrics.

  It is expected that there would have to be accompanying Interim Measures funding or other agreements that would involve cost to the project as part of any understandings or agreements for highway improvements. We have added $1,000,000 for this purpose, but such costs are very, very rough and may not be direct costs to a highway project.

- T'it'kit (Lillooet) Band

The T'it'kit Band is a member of Stl'atl'imx Nation and Lillooet Tribal Council and is not in Treaty process. It is not expected that there are any direct impacts to the T'it'kit from Highway 99 upgrading.

4.6.5 Lillooet to Highway 97

- Xaxli'p First Nation (Fountain Band)

  The Xaxli'p are in the Treaty process but interest specifics, and any concerns related to existing reserves is sketchy. As relocation/re-alignment of Highway 99 is needed through portions of the main reserve it is anticipated that there will be significant issues. In addition, it should be noted that the status of the existing Highway 99 right-of-way is in dispute.

  It is expected that there would have to be accompanying Interim Measures funding or other agreements that would involve cost to the project as part of any understandings or agreements for highway improvements. We have added $2,000,000 for this purpose, but such costs are very, very rough and may not be direct costs to a highway project.

- Ts'kw'aylaxw First Nation (Pavillion Band)

  The Ts'kw'aylaxw are in the Treaty Process but interest specifics, and any concerns related to existing reserves is sketchy. There has been some dispute of the existing Highway 99 right-of-way and some minor re-alignment and access improvements are needed in future.

  It is expected that there would have to be accompanying Interim Measures funding or other agreements that would involve cost to the project as part of any understandings or agreements for highway improvements. We have added $1,000,000 for this purpose, but such costs are very, very rough and may not be direct costs to a highway project.

- Stuctwesemc Bonaparte Band

  The Stuctwesemc Bonaparte Band is not in Treaty process. The Band is a member of the Shuswap Nation. In past, the Ministry has done some fencing, but the fence is inside (on the highway side) of the pinned line.

  We have not added any costs in the instance, although there will undoubtedly be some mitigation costs to a project during highway upgrading or construction. This is not felt to as significant as with other areas to the south.

4.7 Road and Bridge Maintenance

4.7.1 Vancouver to Squamish Optional Routes

Cost estimates for road and bridge maintenance for the alternate routes Vancouver to Squamish include the costs of removal of snow and ice, and spent winter abrasives, and hauling away to disposal from the drinking-water supply watersheds.

4.8 Properties

4.8.1 Vancouver to Squamish Optional Routes

The Indian Arm/Indian River option will have an impact on the new Skytrain route at the Lougheed Highway, and on Gaglardi Way. There are also proposed residential developments under review south of Simon Fraser University and north of Gaglardi Way, plus existing townhouse developments, that will be impacted by a new route. Property costs will be high.

Both the Capilano and Seymour options may impact on lands adjacent to the Fern Street Interchange, on townhouse developments traveling north on Lillooet Road and on the North Vancouver Cemetery on Lillooet Road.

The Highway 99 option will also impact on the Fern Street Interchange if Highway 1 is expanded to 6 lanes from there to Taylor as the route north is expanded to four lanes from Horseshoe Bay. This is very expensive real estate, and will impact on developed property in several locations. Developed properties will also be impacted at Lions Bay and there will be impacts at Britannia Beach. Access to remaining businesses could be difficult at Britannia Beach.

All options include grade separation of the intersections in Squamish. This will involve reducing the five current intersections to three interchanges with supporting frontage roads. Property costs will be significant at Squamish.

4.8.2 Squamish to Whistler

The by-pass route at Whistler will be the largest cost driver for properties over this section, although it will minimize the effect to Whistler that may otherwise be necessitated by four-laning to Whistler Village. The majority of the land required for the by-pass is Crown, and a portion of private lands have been dedicated.

4.8.3 Whistler to Pemberton

There are no significant property issues over this section of the highway.

4.8.4 Pemberton to Lillooet

Property negotiations are expected to be difficult, and property costs high, for the alignment of a Highway 99 by-pass of the Mount Currie Reserve.

4.8.5 Lillooet to Highway 97

Property negotiations are expected to be difficult, and property costs high, for the alignment of Highway 99 through the Fountain Reserve.

5. Previous Relevant Studies

5.1 The Vancouver – Squamish Corridor Study (1983)

The Ministry identified and examined three options along the Capilano River, Seymour River, and Indian Arm/Indian River valley corridors. On the Vancouver side, the study considered:

- three connection options for the Capilano corridor:
  - ◊ via the Capilano Road Interchange,
  - ◊ via the Lynn Valley Interchange, and
  - ◊ via the Fern Street Interchange.
- one for the Seymour corridor (via the Fern Street Interchange), and
- three for the Indian Arm corridor:
  - ◊ via the Fern Street Interchange and the west side of Indian Arm,
  - ◊ via Highway 7 in Port Moody and the east side of Indian Arm, and
  - ◊ via the Stormont Interchange in Burnaby and the east side of Indian Arm.

That high-level reconnaissance study was done on a topographic mapping scale of 1:50,000.

5.2 Preliminary Route Comparison Study On Highway 99 from Pemberton to Lillooet (1987)

The Ministry retained Reid Crowther & Partners Ltd. to review three route options for a Highway 99 connection from Pemberton to Lillooet; via the Hurley Pass and Goldbridge, via Anderson and Seton Lakes, and via Duffey Lake. That feasibility report also prepared cost estimates that showed the Duffey Lake route to be the least cost. Subsequently the Duffey Lake route was upgraded, and this has since been paved.

5.3 The Vancouver - Squamish Highway Planning and Pre-Design Engineering Study (1989)

The Ministry commissioned Hamilton & Associates to define the highway planning objectives for the Vancouver to Squamish corridor options, identifying problems and constraints, and developing improvement strategies. They were also asked to further evaluate the options and recommend the preferred option(s) to advance to preliminary design. That study concluded that an improved existing Highway 99 corridor, combined with the proposed Indian Arm corridor, were the most viable options to meet the future traffic demands.

5.4 Preliminary Geotechnical Investigation - Indian Arm Corridor (East Alternative) (1990)

That Ministry report detailed the geology, natural hazards, conflicts with the existing B.C. Hydro power line, and the gas pipeline, and presented preliminary design recommendations.

5.5 *Sea to Sky Highway Project Report (February 1991)*

Klohn Leonoff, in association with Buckland & Taylor and Graeme & Murray, were retained to investigate and assess the following further detail for the combined Indian Arm corridor, and upgrading of the existing Highway 99 corridor, option:

- advantages and disadvantages
- geotechnical challenges
- natural hazards and risks related thereto
- environmental and socio-economic issues

In addition, the capital and maintenance costs for improving the existing Highway 99 corridor was to be compared to the Indian Arm corridor option.

5.6 *Squamish – Whistler Highway Planning and Pre-Design Engineering Study (July 1991)*

Hamilton & Associates was commissioned to define the highway planning objectives, identify viable options for, and to recommend improvement strategies for the Squamish to Whistler section of the 'Sea to Sky' Highway 99. This was approached in the same manner as the highway planning and pre-design engineering study for the Vancouver to Squamish corridor options. The study involved improving the existing alignment of Highway 99, and an alternative corridor on the west flank of the Cheakamus River. The options considered included a six-lane cross-section on either corridor, or a combination of three-lane cross-sections on each corridor (one way couplets if you like). The evaluation analysis resulted in favor of six-laning along the existing Highway 99 alignment.

5.7 *Sea to Sky Highway – Caulfield Interchange to Furry Creek (1992)*

Klohn Leonoff, in association with Buckland and Taylor and Graeme and Murray, was retained by the Ministry to carry out the functional design of the Sea to Sky Highway 99 corridor from Caulfield Interchange in North Vancouver to Furry Creek, a distance of 28 km. The new alignment was designed to a four-lane expressway standard of 90 km/hr and involved extensive rock cuts, retaining walls, tunnels and structures. That report forms the basis of the subsequent Reid Crowther review in 2001 and our review in this report.

5.8 *Highway 99 Multi-modal Corridor Transportation study (2001)*

Reid Crowther and Partners Ltd. was commissioned to carry out a major multi-modal transportation study from Horseshoe Bay to Highway 97 near Cache Creek. That study involved a review of traffic volumes and projections, modes of transportation in the corridor and corridor options to support future decision-making and planning for the corridor over the next 25 years. The multi-modal approach included consideration of highway, rail, marine, air and highway bus modes.

The options considered included potential alternatives for a full range of strategic, operational, and infrastructure responses to growth in travel demand, including transportation demand and growth management.

The evaluation analysis resulted in significantly revised projections of highway traffic volumes from the previous work by Hamilton & Associates in 1989 and 1991. Rather than a

requirement for 8 lanes from Vancouver to Squamish, and 6 lanes from Squamish to Whistler, to the year 2014, that latest study suggests that 4 lanes to Squamish and 2-3 lanes to Whistler are sufficient until 2025. We have utilized these latest projections in setting our design criteria for this report.

5.9 Highway 99 Short-Term Project Evaluation study (2001)

Earth Tech (Canada) Inc., the new company name for Reid Crowther, was asked to prepare a further report identifying short-term Highway 99 corridor improvements that could be undertaken on a project/site-specific basis, including benefit/cost discussion for each. The results of that study have been used as a "check" to ensure the corridor improvement options produced and cost estimated in our report (this study) have included their recommendations.

Most of the recommended improvement are incorporated automatically in the corridor upgrading we have recommended in this report. We would caution, however that their recommended progressive addition of passing lanes should be very carefully considered with respect to the potential to encourage speeding behaviour.

APPENDICES

Appendix A

Vancouver to Squamish Alternative Routes

Project Cost Estimates

The following are very rough estimates of the total project cost estimates, including grade/rock construction, structures, environmental and First Nation mitigation, engineering (detailed survey, design, etc.), property acquisition, project supervision/management, etc. for each of the alternate routes from Vancouver to Squamish:

Vancouver to Squamish Route Options - Project Costs

Vancouver to Squamish	Kms	Construction	Bridges & Snowsheds	Special Mitigation	Engineering	Properties	Management Reserve	Project Sup /Mgt	**Total Hwy. Section**
Existing Route Highway 99	69	$894,256,319	$110,272,620	$1,000,000	$65,978,984	$104,100,000	$56,755,355	$61,191,297	**$ 1,294 Million**
Capilano River Route	59	$1,458,120,909	$229,579,449	$271,000,000	$102,182,407	$50,650,000	$86,873,612	$100,466,182	**$ 2,299 Million**
Seymour River Route	55	$2,470,047,927	$270,632,188	$587,000,000	$175,539,793	$35,950,000	$145,409,260	$170,713,975	**$ 3,855 Million**
Indian Arm Route	67	$2,546,072,218	$632,991,466	$165,000,000	$184,176,344	$46,450,000	$148,426,524	$176,496,161	**$ 3,900 Million**

Notes:

1. Included in the costs for special mitigation above are the costs of containing the drainage from the highways in drinking-water watersheds. In the case of the Capilano option this is roughly estimated to be $270 Million at construction; for the Seymour option this would be $585 Million ; for the Indian Arm/Indian River option this would be $120 Million. We have also added $40 Million for special mitigation for parks and estuary areas in the Indian Arm/Indian River option.
2. Included in the costs for special mitigation above are the costs of First Nations special agreements or impact mitigation as described in Section 4.6 of this report.
3. Included in the construction costs above are the costs of tender contingency and traffic management during construction. For the latter, in the case of the Highway 99 option, this is approximately $7.5 Million over a seven-year period. However, **the disruption and delay to the traveling public may be a far more significant issue**.

Appendix B

Squamish to Highway 97

Project Cost Estimates

The following table represents the total project cost estimates, including grade/rock construction, structures, environmental and First Nation mitigation, engineering (detailed survey, design, etc.), property acquisition, project supervision/management, etc.:

Highway 99 Route Improvements - Project Costs

	Kms	Construction	Bridges & Snowsheds	Special Mitigation	Engineering	Properties	Management Reserve	Project Sup./Mgt.	**Total Hwy. Section**
Squamish to Whistler	59	$279,792,000	$23,775,360	$0	$20,502,000	$19,000,000	$14,472,000	$19,296,000	**$ 370 Million**
Whistler to Pemberton	22	$47,757,200	$4,443,180	$0	$3,499,450	$800,000	$2,470,200	$3,293,600	**$ 62 Million**
Pemberton to Lillooet	97	$423,922,000	$25,184,544	$4,000,000	$31,063,250	$1,600,000	$21,927,000	$29,236,000	**$ 537 Million**
Lillooet to Hwy. 97	74	$101,395,600	$10,071,640	$3,000,000	$7,429,850	$3,250,000	$5,244,600	$6,992,800	**$ 137 Million**
TOTAL	**252**	$852,866,800	$63,474,724	$7,000,000	$62,494,550	$24,650,000	$44,113,800	$58,818,400	**$ 1,106 Million**

Notes: 1. Included in the costs for special mitigation above are the costs of First Nations special agreements or impact mitigation as described in Section 4.6 of this report.
2. The construction costs above include the cost of tender contingency and traffic management.

Appendix C

Vancouver to Squamish Alternative Routes

Route Comparison

LOWER MAINLAND to SQUAMISH ALTERNATIVE ROUTES

Qualitative Route Comparison, Based on the Multiple Account Evaluation Format

Financial Account

- base route capital cost:
  - H99n 4 lane cost can be considerably reduced by using existing road for southbound lanes
  - high property cost expected through Kelvin Grove, Lions Bay and Britannia
  - mountainous terrain and watersheds indicate high construction cost – barriers, sheds, walls, bridges - for the alternate routes
  - Seymour/Indian River route eliminates Third Narrows bridge and Seymour watershed costs, but adds a long tunnel

- link to Provincial system cost:
  - all options must include highway improvements through Squamish. The H99n and Capilano options likely would remain 4 lanes, when the Seymour and Indian Arm routes near capacity, they could necessitate 6 lanes through Squamish, due to local traffic.
  - the H99n, Capilano, Seymour and Seymour/Indian River routes require linkage to the Fern Street Interchange
  - the Indian Arm route may include interchanges at Highway 7 and Highway 7A, as well as reconstruction of Gaglardi interchange

- network improvement cost:
  - in the long term, when the H99n, Capilano, Seymour and Seymour/Indian River routes approach capacity, the First and Second Narrows bridges could require capacity increase to accommodate generated commuter traffic
  - in addition to interchanges at Highway 7 and Highway 7A, the Indian Arm route could necessitate major upgrade to TCH to accommodate the 4 lane freeway linking at Gaglardi interchange, because of the linkage of the potential Stormont-McBride connector also at the Gaglardi interchange. Consequently, the generated urban traffic could significantly exceed the long distance traffic.
  - access control through Squamish will necessitate reconfiguration of the Squamish municipal road network

- operating and maintenance cost
  - the existing Highway 99n will continue as a Provincial facility, so H99n operating and maintenance costs must be added to the other route options
  - O&M for the alternate routes expected to be high due to high snow fall and crossing avalanche tracks
  - construction and operation of run-off containment systems through watersheds is costly
  - the Seymour/Indian River route does not impact the Seymour watershed, but still impacts the Squamish watershed

- traffic disruption/management cost
  - H99n expected to experience the highest level of user disruption during construction, due to continuous traffic usage
  - Indian Arm option may also be significant, due to urban construction on high volume TCH, Highway 7 and Highway 7A
  - the other alternate routes expected to have minimal disruption at Fern Street interchange

Customer Service Account

- user travel time cost reduction:
  - while a travel demand forecast is not needed to determine highway capacity, it is needed to determine user benefits. MoTH assessed the previous long distance travel demand forecast as being too high, the traffic and growth trend forecast used in 1989 has not been achieved
  - the available travel distance information indicates that the alternative routes could increase user cost, reducing the social benefits for the alternate routes.
  - new origin-destination information is required to properly assess current long distance user benefits.
  - the local inter-urban/commuter volume could be higher than the long distance highway traffic, increasing the total user benefits, but network modeling is required to quantify

- system integration:
  - all routes will link to the TCH, but Indian Arm route has highest system integration potential. It could provide a new urban link between Highway 7, Highway 7A and the TCH. As well, the potential Stormont-McBride connector would link to TCH at the Gaglardi Interchange. This links the new route to the growth concentration areas in the Lower Mainland. The inter-urban traffic could easily exceed the base highway traffic. This level of integration could cause the Gaglardi interchange to develop the same problems as Cape Horn, requiring both the interchange and the TCH to be significantly upgraded.
  - Lower Mainland network modeling is required to properly estimate the traffic volume and supporting improvements

- mode shift potential:
  - potential different for various trip purposes; recreation, commercial, commuter
  - only H99n has potential for a commuter and ski train to reduce highway demand

- traffic diversion:
  - the potential for traffic diversion from the existing highway to an alternate route is a function of user origin and destination of each type of trip; skier residence, business location and commuter work place and travel time/cost.
  - current O-D information is not available, but old information indicates skier and commuter traffic to be oriented to the west side of the Lower Mainland.
  - however, the system integration of the Indian Arm route could change the current O-D pattern.
  - except for the proposed Stormont-McBride Connector, the existing highway likely would remain the best route for tourists from the CBD hotels, airport and US via I-5
  - if insufficient traffic diverted onto the new route, the expected residential growth along Howe Sound may require the existing H99n to be 4 laned in addition to the new route

- timing of benefits:
  - as the new routes are all or nothing, the benefit stream is delayed until completion
  - improvement to the existing highway will yield an immediate incremental benefit to users

- value of time:
  - the value of time saved is determined by the trip purpose, recreation trips which are likely the highest volume, have the lowest value, while commercial trips have the highest value

- vehicle operating cost reduction
  - increase in design standard has bi-polar impact on vehicle operating cost: smoother operation reduces cost while higher operating speed increases cost
  - while the Indian Arm and existing Highway 99n have about 10 km more 4 lane than the Capilano and Seymour routes, new information about trip origin is required to permit comparison of relative travel distance.
  - for example, increased travel distance via Indian Arm for major skier origins; CBD hotels, airport and I-5 could increase skier operating and time cost

- accident cost reduction
  - reduction in accident cost will be a major social benefit, all 4 lane routes will equally reduce accident rates and severity in proportion to usage
  - if a new route is chosen, the accident cost on existing H99n may warrant major safety improvements, in addition to the new route

Economic Development Account

- value of developable land accessed
  - value reduced by the servicing cost, which could be significant for new rural areas
  - existing H99n accesses existing and planned major communities
  - area of land accessed by Indian Arm route is uncertain, due to many social and environmental constraints

- interior interaction
  - Highway 99n is not seen as a strategic alternative to Highway 1. Thus, the revenue generating interaction with the Interior should be unaffected by a new routes to Squamish

- induced travel
  - all 4 lane routes are expected to induce new commuter traffic.
  - facilitating highway oriented commuter traffic may be considered as detrimental to current Lower Mainland growth management plans
  - urban network planning needed to determine the impact linking Highway 7, Highway 7A and the TCH, capacity improvements to the TCH may be required

Social Account

- urban land use impact
  - the H99n route has the lowest Lower Mainland land use impact, but Lions Bay and Britannia negatively impacted, particularly by interchange footprint
  - the Indian Arm route may affect a new residential community planned for Burnaby Mountain, the new SkyTrain line is impacted, as well land for two new urban interchanges is needed
  - Capilano, Seymour and Seymour/Indian River routes impact a residential area and a community college in North Vancouver, overall, width appears available
  - all options will negatively impact Squamish, due to widening and restructuring the municipal network to achieve a freeway level facility
  - all options impact Whistler similarly

- park/recreation impact
  - the Indian Arm route impacts Belcarra Regional Park, Buntzen Lake Park and the new Indian Arm Provincial Park

- Capilano, Seymour and Seymour/Indian River routes impact the Lower Seymour Conservancy

- First Nations impact
  - the upper and lower Indian River areas are potential Tsleil Waututh Treaty Settlement Land
  - the Tsleil Waututh wish the Indian River headwaters area to be protected
  - the H99n right of way through Stawamus IR#24, south of Squamish, is under dispute by the Squamish Nation, which has indicated a lack of support for upgrading H99n

- public perception
  - public reaction to a much demanded third crossing of the Burrard Inlet in a location that does not meet local travel desire lines may not be positive. Other routes, which utilize the Second Narrows Bridge are more suited to Lower Mainland travel patterns, particularly if bridge capacity is improved.

- consistency with GVRD and SLRD growth plans
  - the GVRD growth strategy concentrates growth in core urban areas. Thus, all of the options which facilitate residences away from the core, but allow commuting to Vancouver jobs are contrary to the Livable Region Strategy
  - The SLRD growth area is the Howe Sound; Porteau, Furry Creek and Britannia. Planned growth in the H99n corridor may necessitate H99n be 4 laned or an equally costly rail commuter service initiated, regardless of other routes to Squamish.

- emergency routes
  - H99n is expected to be seriously damaged in a major earthquake
  - the alternate routes may also be susceptible due to mountainous terrain
  - most likely emergency service is Howe Sound ferry to Squamish

Environmental Account

- watershed impact
  - Capilano and Seymour routes are in Lower Mainland watersheds, while the Seymour/Indian River and Indian Arm routes traverse the Squamish watershed. Total containment of all run-off is considered mandatory
  - opening the mineralization in the Indian River and Stawamus River watershed poses serious water quality hazard

- physical environmental impact
  - all routes cross major fish bearing streams, which will invoke short construction windows and increase cost estimates
  - recent experience indicates that greater use of clear spans will be required, increasing original cost estimates
  - any disturbance of the soft sediments at Britannia Beach could release serious contamination into Howe Sound

- geotechnical concerns
  - the cost and impact of rock cuts on H99n can be significantly reduced by splitting the north and south bound lanes
  - Seymour route considered to have the highest potential rock fall and debris torrent hazard, even though the Indian Arm route has the highest number of hazards identified

- the Capilano route crosses several torrent paths, mitigation estimated at $60,000,000
- Capilano and Seymour routes have poor aggregate availability, long haul will be required
- Indian Arm route have poor aggregate supply north of Meslilloet Creek into the Stawamus River area, long haul will be required.
- earlier proposals to dump construction debris into Howe Sound is no longer considered feasible, rock can be crushed on site, due to water transport available, any excess can be marketed in Lower Mainland
- from geotechnical perspective, Capilano is preferred route

- avalanche concern
  - no recorded avalanches on H99n, no special provisions required
  - the Capilano route could require 6 avalanche defense structures, cost estimated at $7,000,000
  - Seymour route could require15 defense structures, cost estimated at $134 million
  - Indian Arm route could require 8 defense structures. Base cost estimated at $23.5 million, plus extra cost of $143 million, if realignment is not feasible

- archeology
  - areas of concern include the Burrard Inlet crossing site, the Indian River estuary and river valley sections

A Table showing the relative, but unweighted, comparisons and ratings for the various accounts and factors is shown on page 11.

Appendix D

Project Cost Estimates

Summary Detailed Estimating Sheets

File: M:\Hwy. 99 Route Study\Print Documents\[Van-Squamish Summary Estimates.xls]SUMOFSUMS npany Con. Est. **Vancouver - Squamish** (2000 Dollars **Alternative Routes** ACTIVITY **Conceptual Estimates** CODE May 31, 2001			Improved Hwy #99 Horseshoe Bay - Squamish Conceptual Estimate	Capilano Route Conceptual Estimate	Seymour Route Conceptual Estimate	Indian Arm Route Conceptual Estimate
		MAIN RD	52900	59200	55000	67000
Blk Est.		OTHER ROADS	0	0	0	0
Version May.310/01		DESCRIPTION \TOTAL ROADS	52900	59200	55000	67000
2500		PLANNING				
2521	Consultant	- transport. planning study	0	0	0	0
2531	Consultant	- corridor study	0	0	0	0
2541	Consultant	- functional plan. study	0	0	0	0
2502	Consultant	- general	0	0	0	0
	Consultant sub-total		0	0	0	0
2510	Ministry	- project ident.	0	0	0	0
2520	Ministry	- transport. planning study	0	0	0	0
2530	Ministry	- corridor study	0	0	0	0
2540	Ministry	- functional plan. study	0	0	0	0
2501	Ministry	- general	0	0	0	0
	Ministry Sub-total		0	0	0	0
2599	Planning Contingency		0	0	0	0
		TOTAL PLANNING	0	0	0	0
3000		PRELIMINARY DESIGN				
3013	Consultant	- aerial base plan	0	0	0	0
3014	Consultant	- mapping	529,000	751,000	755,000	734,000
3015	Consultant	- control survey	0	0	0	0
3021	Consultant	- environmental impact	158,700	225,300	226,500	220,200
3031	Consultant	- funct.-road field survey	423,200	600,800	604,000	587,200
3041	Consultant	- functional design	264,500	375,500	377,500	367,000
3051	Consultant	- funct. structural des.	2,032,181	520,835	2,518,991	3,997,705
3061	Consultant	- geotechnical design	158,700	225,300	226,500	220,200
3071	Consultant	- right-of-way research	4,100	1,050	1,200	900
3002	Consultant	- general	0	0	0	0
	Consultant sub-total		3,570,381	2,699,785	4,709,691	6,127,205
3010	Ministry	- aerial base plan	0	0	0	0
3011	Ministry	- mapping	0	0	0	0
3012	Ministry	- control survey	0	0	0	0
3020	Ministry	- environmental impact	0	0	0	0
3030	Ministry	- funct.-road field survey	0	0	0	0
3040	Ministry	- functional design	0	0	0	0
3050	Ministry	- funct. structural des.	0	0	0	0
3060	Ministry	- geotechnical design	0	0	0	0
3070	Ministry	- right-of-way research	0	0	0	0
3001	Ministry	- general	0	0	0	0
	Ministry Sub-total		0	0	0	0
3099	Preliminary design Contingency		535,557	404,968	706,454	919,081
	TOTAL PRELIMINARY DESIGN		4,105,938	3,104,753	5,416,144	7,046,286

File: M:\Hwy. 99 Route Study\Print Documents\[Van-Squamish Summary Estimates.xls]SUMOFSUMS npany Con. Est. **Vancouver - Squamish** (2000 Dollars **Alternative Routes** ACTIVITY CODE **Conceptual Estimates** May 31, 2001			Improved Hwy #99 Horseshoe Bay - Squamish Conceptual Estimate	Capilano Route Conceptual Estimate	Seymour Route Conceptual Estimate	Indian Arm Route Conceptual Estimate
		MAIN RD	52900	59200	55000	67000
Blk Est.		OTHER ROADS	0	0	0	0
Version May.310/01		DESCRIPTION \TOTAL ROADS	52900	59200	55000	67000
6700		UTILITIES				
6710	Util. Prov.	- B.C. Hydro	529,000	751,000	755,000	734,000
6711	Util. Prov.	- B.C. telephone	0	0	0	0
	Util. Prov.	sub-total	529,000	751,000	755,000	734,000
6712	Util.Others	- pipelines	0	0	0	0
6713	Util.Others	- telecommunication	0	0	0	0
6714	Util.Others	- storm & sewer inspect.	0	0	0	0
6715	Util.Others	- waterworks inspect.	0	0	0	0
6716	Util.Others	- engineering services	0	0	0	0
6717	Util.Others	- parks/recreation-prel.	0	0	0	0
6718	Util.Others	- transit	0	0	0	0
6719	Util.Others	- tr-ops/signs & detours	0	0	0	0
6701	Util.Others	- general	0	0	0	0
	Util.Others	sub-total	0	0	0	0
6799	Util.Others	Contingency	79,350	112,650	113,250	110,100
	TOTAL UTILITIES		608,350	863,650	868,250	844,100
5000		GRADE CONSTRUCTION				
5032	Grade Const	- water	0	0	0	0
5033	Grade Const	- sanitary	0	0	0	0
5034	Grade Const	- storm	18,016,250	19,285,000	13,055,000	25,690,000
5031	Grade Const	- utility general	830,813	964,250	652,750	1,284,500
5039	Grade Const	- utility contingency	2,827,059	3,037,388	2,056,163	4,046,175
	Grade Const.	Utilities Sub-total	21,674,122	23,286,638	15,763,913	31,020,675
5010	Grade Const	- site prep./clear,grubbing	2,166,720	3,495,360	3,144,000	2,836,800
5020	Grade Const	- road grade/exc,placing,fill	229,122,461	484,715,556	922,772,629	935,636,850
5030	Grade Const	- drainage/pipe,cul.	1,253,219	7,194,210	3,119,043	2,894,444
5040	Grade Const	- multiplate	0	0	0	0
5050	Grade Const	-SGSB/produce,place,comp	9,187,858	14,132,048	10,962,389	13,588,155
5051	Grade Const	-CBC/produce,place,comp	6,830,970	11,800,242	9,656,056	9,653,307
5060	Grade Const	- grade finishing landscaping	0	0	0	0
5061	Grade Const	- grade finishing hydro seed.	758,772	1,202,816	1,155,776	920,544
5062	Grade Const	- grade finishing fencing	0	0	0	0
5063	Grade Const	- noise barriers	0	0	0	0
5064	Grade Const	- passing lanes	0	72,900,000	86,400,000	81,000,000
5090	Grade Const	- sidewalks,curb & gutter	0	0	0	0
5005	Grade Const	-detours c/w ex,bf,paving	3,236,000	3,564,000	1,932,004	3,416,000
5001	Grade Const	-urban design & general	7,576,680	17,970,127	31,174,257	31,498,383
5099	Grade Const	- Contingency	39,019,902	92,546,154	160,547,423	162,216,673
	Grade Construction	Sub-total	299,152,583	709,520,512	1,230,863,576	1,243,661,156
	GRADE CONSTRUCTION COSTS		320,826,705	732,807,150	1,246,627,489	1,274,681,831
3510	Grade Eng.	- detailed design	22,457,869	51,296,500	87,263,924	89,227,728
3519	Grade Eng.	- detailed design/Contingency	3,368,680	7,694,475	13,089,589	13,384,159
6810	Grade Eng.	- general const. supervision	14,758,028	33,709,129	57,344,864	58,635,364
6811	Grade Eng.	- quality assurance	10,266,455	23,449,829	39,892,080	40,789,819
6812	Grade Eng.	- surveying	6,416,534	14,656,143	24,932,550	25,493,637
6819	Grade Eng.	- Residency Contingency	4,716,153	10,772,265	18,325,424	18,737,823
	Grade Engineering	Sub-total	61,983,719	141,578,341	240,848,431	246,268,530
	Total Grade Const. & Eng. Costs		382,810,424	874,385,491	1,487,475,920	1,520,950,361

File: M:\Hwy 99 Route Study\Print Documents\[Van-Squamish Summary Estimates.xls]SUMOFSUMS npany Con. Est. **Vancouver - Squamish** (2000 Dollars **Alternative Routes** ACTIVITY **Conceptual Estimates** CODE May 31, 2001			Improved Hwy #99 Horseshoe Bay - Squamish Conceptual Estimate	Capilano Route Conceptual Estimate	Seymour Route Conceptual Estimate	Indian Arm Route Conceptual Estimate
		MAIN RD	52900	59200	55000	67000
Blk Est.		OTHER ROADS	0	0	0	0
Version May 310/01		DESCRIPTION \TOTAL ROADS	52900	59200	55000	67000
5500		STRUCTURAL CONSTRUCTION				
5522	Struct.Const -	water	0	0	0	0
5523	Struct.Const -	sanitary	0	0	0	0
5524	Struct.Const -	storm	0	0	0	0
5521	Struct.Const -	utility general	0	0	0	0
5599	Struct.Const -	utility contingency	0	0	0	0
	Structural Const. Utilities Sub-total		0	0	0	0
5510	Struct.Const -	tunnel site preparation	0	0	0	0
5511	Struct.Const -	tunnel construction	312,611,450	83,477,839	417,398,036	596,883,023
5512	Struct.Const -	snow shed site prep.	0	0	0	0
5513	Struct.Const -	snow shed site const.	0	0	0	0
5514	Struct.Const -	bridge site preparation	0	0	0	0
5515	Struct.Const -	bridge piers	0	0	0	0
5516	Struct.Const -	bridge abutments	0	0	0	0
5517	Struct.Const -	bridge superstructure	0	0	0	0
5518	Struct.Const -	retain. wall site prep.	0	0	0	0
5519	Struct.Const -	retaining wall const.	30,517,450	4,463,975	7,927,500	78,120,000
5501	Struct.Const -	general & urban design	10,293,867	2,638,254	12,759,767	20,250,091
5529	Struct.Const -	Contingency	53,013,415	13,587,010	65,712,798	104,287,967
	Structural Construction Sub-total		406,436,182	104,167,078	503,798,121	799,541,081
	STRUCTURAL CONSTRUCTION COSTS		406,436,182	104,167,078	503,798,121	799,541,081
3520	Struct. Eng.	- detailed design	30,482,714	7,812,531	37,784,859	59,965,581
3529	Struct. Eng.	- detailed design/Contingency	4,572,407	1,171,880	5,667,729	8,994,837
6820	Struct. Eng.	- general const. supervision	18,289,628	4,687,519	22,670,915	35,979,349
6821	Struct. Eng.	- quality assurance	12,193,085	3,125,012	15,113,944	23,986,232
6822	Struct. Eng.	- surveying	2,032,181	520,835	2,518,991	3,997,705
6829	Struct. Eng.	- Residency Contingency	4,877,234	1,250,005	6,045,577	9,594,493
	Structural Engineering Sub-total		72,447,250	18,567,782	89,802,015	142,518,198
	Total Structural & Eng. Costs		478,883,432	122,734,860	593,600,136	942,059,278

File: M:\Hwy. 99 Route Study\Print Documents\[Van-Squamish Summary Estimates.xls]SUMOFSUMS
npany Con. Est. **Vancouver - Squamish**
(2000 Dollars **Alternative Routes**
ACTIVITY CODE **Conceptual Estimates**
May 31, 2001

Blk Est.
Version May.31/01

ACTIVITY CODE	DESCRIPTION	Improved Hwy #99 Horseshoe Bay - Squamish Conceptual Estimate	Capilano Route Conceptual Estimate	Seymour Route Conceptual Estimate	Indian Arm Route Conceptual Estimate
	MAIN RD	52900	59200	55000	67000
	OTHER ROADS	0	0	0	0
	TOTAL ROADS	52900	59200	55000	67000
6000	PAVING CONSTRUCTION				
6020	Paving Cons - machine paving asphalt	14,780,652	21,712,885	17,132,451	19,780,564
6030	Paving Cons - machine paving concrete	0	0	0	0
6040	Paving Cons - hot reprofiling	0	0	0	0
6050	Paving Cons - shoulder paving	0	0	0	0
6060	Paving Cons - pavement finishing	0	0	0	0
6070	Paving Cons - seal coating	0	0	0	0
6001	Paving Cons - general	443,420	651,387	513,974	593,417
6010	Paving Cons - pavement design	0	0	0	0
6099	Paving Cons - Contingency	2,283,611	3,354,641	2,646,964	3,056,097
	PAVING CONSTRUCTION COSTS	17,507,682	25,718,913	20,293,388	23,430,078
3560	Paving Eng. - detailed design	1,225,538	1,800,324	1,420,537	1,640,105
3569	Paving Eng. - detailed design/Contingency	183,831	270,049	213,081	246,016
6860	Paving Eng. - general const. supervision	525,230	771,567	608,802	702,902
6861	Paving Eng. - quality assurance	875,384	1,285,946	1,014,669	1,171,504
6862	Paving Eng. - surveying	175,077	257,189	202,934	234,301
6869	Paving Eng. - Residency Contingency	236,354	347,205	273,961	316,306
	Paving Engineering Sub-total	3,221,413	4,732,280	3,733,983	4,311,134
	Total Paving Const. & Eng. Costs	20,729,095	30,451,193	24,027,371	27,741,212
6500	OPERATIONAL CONSTRUCTION				
6510	Operat.Cons - lighting	0	0	0	0
6520	Operat.Cons - signals	0	0	0	0
6530	Operat.Cons - signing	70,000	35,000	40,000	30,000
6540	Operat.Cons - guard rail	3,703,000	8,964,200	13,755,000	11,123,000
6550	Operat.Cons - pavement markings	376,863	525,175	449,925	488,425
6501	Operat.Cons - general	124,496	285,731	427,348	349,243
6599	Operat.Cons - contingency	641,154	1,471,516	2,200,841	1,798,600
	OPERATIONAL CONSTRUCTION COSTS	4,915,512	11,281,622	16,873,114	13,789,268
3540	Operat. Eng. - detailed design	344,086	789,714	1,181,118	965,249
3549	Operat. Eng. - detailed design/Contingency	51,613	118,457	177,168	144,787
6840	Operat. Eng. - general const. supervision	294,931	676,897	1,012,387	827,356
6841	Operat. Eng. - quality assurance	98,310	225,632	337,462	275,785
6842	Operat. Eng. - surveying	49,155	112,816	168,731	137,893
6849	Operat. Eng. - Residency Contingency	66,359	152,302	227,787	186,155
	Operational Enginering Sub-total	904,454	2,075,818	3,104,653	2,537,225
	Total Operational Const.& Eng.Costs	5,819,966	13,357,441	19,977,767	16,326,493

File: M:\Hwy. 99 Route Study\Print Documents\[Van-Squamish Summary Estimates.xls]SUMOFSUMS npany Con. Est. **Vancouver - Squamish** (2000 Dollars **Alternative Routes** ACTIVITY CODE **Conceptual Estimates** May 31, 2001		Improved Hwy #99 Horseshoe Bay - Squamish Conceptual Estimate	Capilano Route Conceptual Estimate	Seymour Route Conceptual Estimate	Indian Arm Route Conceptual Estimate
	MAIN RD	52900	59200	55000	67000
Blk Est.	OTHER ROADS	0	0	0	0
Version May.310/01	DESCRIPTION \TOTAL ROADS	52900	59200	55000	67000
5200	ROAD SIDE CONSTRUCTION				
5203	RoadSide Cc - water	0	0	0	0
5204	RoadSide Cc - sanitary	0	0	0	0
5205	RoadSide Cc - storm	0	0	0	0
5202	RoadSide Cc - general	0	0	0	0
5209	RoadSide Cc - Utility Contingency	0	0	0	0
	Road Side Const. Utilities Sub-total	0	0	0	0
5210	RoadSide Cc - weighscales	0	0	0	0
5220	RoadSide Cc - tourist info centers	0	0	0	0
5230	RoadSide Cc - tourist rest & view areas	0	0	0	0
5201	RoadSide Cc - general & urban design	0	0	0	0
5299	RoadSide Cc - Contingency	0	0	0	0
	Road Side Construction Sub-total	0	0	0	0
	ROAD SIDE CONSTRUCTION COSTS	0	0	0	0
3550	RoadSide En - detailed design	0	0	0	0
3559	RoadSide En - detailed design/Contingency	0	0	0	0
6850	RoadSide En - general const. supervision	0	0	0	0
6851	RoadSide En - quality assurance	0	0	0	0
6852	RoadSide En - surveying	0	0	0	0
6859	RoadSide En - Residency Contingency	0	0	0	0
	Road Side Engineering Sub-total	0	0	0	0
	Total Road Side Const.& Eng.Costs	0	0	0	0
5300	OTHER CONSTRUCTION				
5303	Other Const. - water	0	0	0	0
5304	Other Const. - sanitary	0	0	0	0
5305	Other Const. - storm	0	0	0	0
5302	Other Const. - utility general	0	0	0	0
5309	Other Const. - utility contingency	0	0	0	0
	Other Const. Utilities Sub-total	0	0	0	0
5310	Other Const. - railroads main & spur lines	0	0	0	0
5320	Other Const. - railroad crossings	0	0	0	0
5330	Other Const. - marine work	0	0	0	0
5340	Other Const. - environmental mitigations	25,162,602	350,949,275	335,026,889	117,678,294
5301	Other Const. - general	0	0	0	0
5399	Other Const. - Contingency	3,774,390	52,642,391	50,254,033	17,651,744
	Other Construction Sub-total	28,936,993	403,591,666	385,280,922	135,330,039
	OTHER CONSTRUCTION COSTS	28,936,993	403,591,666	385,280,922	135,330,039
3570	Other Eng. - detailed design	2,095,589	28,286,417	27,009,665	9,503,103
3579	Other Eng. - detailed design/Contingency	314,338	4,242,962	4,051,450	1,425,465
6870	Other Eng. - general const. supervision	896,110	12,121,750	11,574,428	4,071,901
6871	Other Eng. - quality assurance	868,110	12,107,750	11,558,428	4,059,901
6872	Other Eng. - surveying	868,110	12,107,750	11,558,428	4,059,901
6879	Other Eng. - Residency Contingency	394,849	5,450,587	5,203,692	1,828,756
	Other Engineering Sub-total	5,437,107	74,317,216	70,956,090	24,949,027
	Total Other Const.& Eng.Costs	34,374,099	477,908,882	456,237,012	160,279,066

File: M:\Hwy. 99 Route Study\Print Documents\[Van-Squamish Summary Estimates.xls]SUMOFSUMS npany Con. Est. **Vancouver - Squamish** (2000 Dollars **Alternative Routes** ACTIVITY CODE **Conceptual Estimates** May 31, 2001			Improved Hwy #99 Horseshoe Bay - Squamish Conceptual Estimate	Capilano Route Conceptual Estimate	Seymour Route Conceptual Estimate	Indian Arm Route Conceptual Estimate
		MAIN RD	52900	59200	55000	67000
Blk Est. Version May.310/01		OTHER ROADS	0	0	0	0
		DESCRIPTION \TOTAL ROADS	52900	59200	55000	67000
3500		DETAILED DESIGN				
	from 3510,3520,3540,3550,3570		65,096,665	103,483,308	177,859,118	185,497,031
3530	Geotech. En	- detailed design	5,802,807	9,497,136	16,169,999	16,747,373
3539	Geotech. En	- Contingency	870,421	1,424,570	2,425,500	2,512,106
	TOTAL DETAILED DESIGN COSTS		71,769,893	114,405,015	196,454,618	204,756,510
6800		RESIDENT ENGINEERING				
	from 6810,6820,6840,6850,6860,6870		78,897,278	137,788,130	230,586,053	235,087,083
	TOTAL RESIDENT ENG. COSTS		78,897,278	137,788,130	230,586,053	235,087,083
9700		RISK CONTINGENCY - general	0	0	0	0
	TOTAL RISK CONTINGENCY		0	0	0	0
		PART 1 SUMMARY				
		CONSTRUCTION	677,592,542	1,111,678,329	1,890,209,812	1,954,449,040
		ENGINEERING & SUPERVISION	134,585,312	221,998,172	376,049,405	388,599,895
		CONTRACTUAL CONTINGENCY	121,826,678	200,051,475	339,938,882	351,457,340
		RISK CONTINGENCY	0	0	0	0
	CONSTRUCTION COST TOTAL		934,004,533	1,533,727,976	2,606,198,099	2,694,506,275

File: M:\Hwy. 99 Route Study\Print Documents\[Van-Squamish Summary Estimates.xls]SUMOFSUMS mpany Con. Est. **Vancouver - Squamish** (2000 Dollars **Alternative Routes** ACTIVITY **Conceptual Estimates** CODE May 31, 2001			Improved Hwy #99 Horseshoe Bay - Squamish Conceptual Estimate	Capilano Route Conceptual Estimate	Seymour Route Conceptual Estimate	Indian Arm Route Conceptual Estimate
		MAIN RD	52900	59200	55000	67000
Blk Est.		OTHER ROADS	0	0	0	0
Version May 310/01		DESCRIPTION \TOTAL ROADS	52900	59200	55000	67000
2000		PROJECT MANAGEMENT				
2060	Project Man.	- office costs wages	14,010,068	23,005,920	39,092,971	40,417,594
2062	Project Man.	- office costs - expenses	4,670,023	7,668,640	13,030,990	13,472,531
2063	Project Man.	- printing costs	0	0	0	0
2061	Project Man.	- general	0	0	0	0
	Project Manager Sub-total		18,680,091	30,674,560	52,123,962	53,890,126
2010	Ministry	- office costs wages	14,010,068	23,005,920	39,092,971	40,417,594
2012	Ministry	- office costs - expenses	4,670,023	7,668,640	13,030,990	13,472,531
2030	Ministry	- printing costs	0	0	0	0
2011	Ministry	- general	0	0	0	0
	Ministry Sub-total		18,680,091	30,674,560	52,123,962	53,890,126
2070	Public Rel.	- wages & expenses	5,137,025	8,435,504	14,334,090	14,819,785
2072	Public Rel.	- adv., media, displays	5,137,025	8,435,504	14,334,090	14,819,785
2073	Public Rel.	- opening ceremonies	14,000	7,000	8,000	6,000
2071	Public Rel.	- general	0	0	0	0
	Public Relations Sub-total		10,288,050	16,878,008	28,676,179	29,645,569
2040	Legal Costs	- lawyers fees	1,868,009	3,067,456	5,212,396	5,389,013
2041	Legal Costs	- general	0	0	0	0
	Legal Costs Sub-total		1,868,009	3,067,456	5,212,396	5,389,013
2080	Insurance	- const./ liability, E&O	11,675,057	19,171,600	32,577,476	33,681,328
2081	Insurance	- general	0	0	0	0
	Legal Costs Sub-total		11,675,057	19,171,600	32,577,476	33,681,328
2099	Project Management Contingency		9,178,695	15,069,927	25,607,096	26,474,424
	TOTAL PROJECT MANAGEMENT COSTS		70,369,991	115,536,110	196,321,072	202,970,585
4000		LAND	14	7	8	6
4010	Land(Code 4	-Mrkt,ROW,Serv,Imp.V,Ease.C,T	90,810,000	61,295,000	73,430,000	49,371,000
	Acquisition Sub-total		90,810,000	61,295,000	73,430,000	49,371,000
4020	Land(Code 4	-Bus.,5%,Mrg.P,Rel$,P/Tax,Etc	9,081,000	6,129,500	7,343,000	4,937,100
4030	Land(Code 4	-Owners(LS,Apprsl,Rprt,Lgl,In	6,356,700	4,290,650	5,140,100	3,455,970
4040	Land(Code 4	-Demolition	140,000	70,000	80,000	60,000
4050	Land(Code 4	-Pro.Man,P.Tax,Util,Security	908,100	612,950	734,300	493,710
4060	Land(Code 4	-Not Used	0	0	0	0
4070	Land(Code 4	-Not Used	0	0	0	0
4080	Land(Code 4	-Acq.F,M/Sal,Trv/V,Cntr.S,Appr.	6,356,700	4,290,650	5,140,100	3,455,970
4090	Land(Code 4	-Surveys	28,000	14,000	16,000	12,000
			0	0	0	0
			0	0	0	0
			0	0	0	0
			0	0	0	0
	Associated costs-sub-total		22,870,500	15,407,750	18,453,500	12,414,750
4099	Land Contingency Sub-total		17,052,075	11,505,413	13,782,525	9,267,863
	TOTAL LAND COSTS		130,732,575	88,208,163	105,666,025	71,053,613

File: M:\Hwy 99 Route Study\Print Documents\[Van-Squamish Summary Estimates.xls]SUMOFSUMS			Improved Hwy #99 Horseshoe Bay - Squamish	Capilano Route	Seymour Route	Indian Arm Route
npany Con. Est.		**Vancouver - Squamish**	Conceptual Estimate	Conceptual Estimate	Conceptual Estimate	Conceptual Estimate
(2000 Dollars		**Alternative Routes**				
ACTIVITY CODE		**Conceptual Estimates** May 31, 2001				
		MAIN RD	52900	59200	55000	67000
Blk Est.		OTHER ROADS	0	0	0	0
Version May.310/01		DESCRIPTION \TOTAL ROADS	52900	59200	55000	67000
9800		MANAGEMENT RESERVE				
	MAN. RES.	- planning	0	0	0	0
	MAN. RES.	- preliminary design	205,297	155,238	270,807	352,314
	MAN. RES.	- utility construction	30,418	43,183	43,413	42,205
	MAN. RES.	- grade construction	16,041,335	36,640,357	62,331,374	63,734,092
	MAN. RES.	- structural construction	20,321,809	5,208,354	25,189,906	39,977,054
	MAN. RES.	- paving construction	875,384	1,285,946	1,014,669	1,171,504
	MAN. RES.	- operation construction	245,776	564,081	843,656	689,463
	MAN. RES.	- roadside construction	0	0	0	0
	MAN. RES.	- other construction	1,446,850	20,179,583	19,264,046	6,766,502
	MAN. RES.	- project management	3,518,500	5,776,805	9,816,054	10,148,529
	MAN. RES.	- land	6,536,629	4,410,408	5,283,301	3,552,681
	MAN. RES.	- detailed eng.	3,588,495	5,720,251	9,822,731	10,237,825
	MAN. RES.	- residency eng.	3,944,864	6,889,406	11,529,303	11,754,354
	MAN. RES.	- risk contingency	0	0	0	0
	TOTAL MANAGEMENT RESERVE		56,755,355	86,873,612	145,409,260	148,426,524
	TOTAL LESS ESCALATION					
	FISCAL					
9900	ESCALATION					
	YEAR	PROJECTED ESCALATION				
9989	1999 - 2000	0.5750%	0	0	0	0
9990	2000 - 2001	0.6250%	0	0	0	0
9991	2001 - 2002	1.0000%	0	0	0	0
9992	2002 - 2003	1.0000%	0	0	0	0
9993	2003 - 2004	1.0000%	0	0	0	0
9994	2004 - 2005	1.0000%	0	0	0	0
9995	2005 - 2006	1.0000%	0	0	0	0
9996	2006 - 2007	1.0000%	0	0	0	0
9997	2007 - 2008	1.0000%	0	0	0	0
	TOTAL ESCALATION		0	0	0	0
	PART 2 SUMMARY NON-CONSTRUCTION COSTS					
		Non-Construction	231,627,152	264,042,545	408,006,735	386,708,435
		Non-Const. Contingency	26,230,770	26,575,340	39,389,621	35,742,287
		TOTAL NON-CONSTRUCTION COST	257,857,921	290,617,885	447,396,357	422,450,721
	DIVISION TOTAL FOR ROAD TYPE		1,191,862,454	1,824,345,861	3,053,594,455	3,116,956,997

File: M:\Hwy 99 Route Study\Print Documents\[Van-Squamish Summary Estimates.xls]SUMOFSUMS mpany Con. Est. **Vancouver - Squamish** (2000 Dollars **Alternative Routes** ACTIVITY CODE **Conceptual Estimates** May 31, 2001			Improved Hwy #99 Horseshoe Bay - Squamish Conceptual Estimate	Capilano Route Conceptual Estimate	Seymour Route Conceptual Estimate	Indian Arm Route Conceptual Estimate
		MAIN RD	52900	59200	55000	67000
Blk Est.		OTHER ROADS	0	0	0	0
Version May 310/01		DESCRIPTION \TOTAL ROADS	52900	59200	55000	67000
	SUMMARY BY ACTIVITY LEVEL					
2000		PROJECT MANAGEMENT	61,191,297	100,466,182	170,713,975	176,496,161
2500		PLANNING	0	0	0	0
3000		PRELIMINARY DESIGN	3,570,381	2,699,785	4,709,691	6,127,205
3500		DETAILED DESIGN	62,408,603	99,482,621	170,830,102	178,049,139
		Total Engineering	65,978,984	102,182,407	175,539,793	184,176,344
4000		LAND ACQUISITION	113,680,500	76,702,750	91,883,500	61,785,750
5000		GRADE CONSTRUCTION	278,979,743	637,223,609	1,084,023,903	1,109,418,984
5200		ROAD SIDE CONSTRUCTION	0	0	0	0
5300		OTHER CONSTRUCTION	25,162,602	350,949,275	335,026,889	117,678,294
5500		STRUCTURAL CONSTRUCTION	353,422,767	90,580,068	438,085,323	695,253,114
6000		PAVING CONSTRUCTION	15,224,071	22,364,272	17,646,424	20,373,981
6500		OPERATIONAL CONSTRUCTION	4,274,358	9,810,106	14,672,273	11,990,668
6700		UTILITY CONSTRUCTION	529,000	751,000	755,000	734,000
6800		RESIDENT ENGINEERING	68,606,328	119,815,765	200,509,612	204,423,551
			0	0	0	0
		Total Construction	746,198,871	1,231,494,094	2,090,719,423	2,158,872,591
9700		TENDER CONTINGENCY	148,057,449	226,626,815	379,328,504	387,199,627
		SUB-TOTAL	1,135,107,099	1,737,472,248	2,908,185,196	2,968,530,473
9800		MANAGEMENT RESERVE	56,755,355	86,873,612	145,409,260	148,426,524
		TOTAL	1,191,862,454	1,824,345,861	3,053,594,455	3,116,956,997
9900		ESCALATION	0	0	0	0
		TOTAL COST	1,191,862,454	1,824,345,861	3,053,594,455	3,116,956,997
		Const. Less Resident Eng.	677,592,542	1,111,678,329	1,890,209,812	1,954,449,040

File: M:\Hwy. 99 Route Study\Print Documents\[Van-Squamish Summary Estimates.xls]SUMOFSUMS
npany Con. Est. **Vancouver - Squamish**
(2000 Dollars) **Alternative Routes**
ACTIVITY CODE **Conceptual Estimates**
May 31, 2001

Blk Est.
Version May 310/01

DESCRIPTION	Improved Hwy #99 Horseshoe Bay - Squamish Conceptual Estimate	Capilano Route Conceptual Estimate	Seymour Route Conceptual Estimate	Indian Arm Route Conceptual Estimate
MAIN RD	52900	59200	55000	67000
OTHER ROADS	0	0	0	0
\TOTAL ROADS	52900	59200	55000	67000
Engineering	146,245,823	233,045,878	398,191,834	414,773,381
Land	130,732,575	88,208,163	105,666,025	71,053,613
Construction	858,128,701	1,416,218,208	2,404,327,337	2,482,703,479
Management Reserve	56,755,355	86,873,612	145,409,260	148,426,524
Escalation	0	0	0	0
Total	1,191,862,454	1,824,345,861	3,053,594,455	3,116,956,997
BASIC QUANTITY SUMMARY				
Construct.Cost ONLY Per L.M.	16,222	18,858	100,180	33,824
Land Area	270.8	436.9	393.0	354.6
Mobilization	19,269,275	22,509,749	45,528,095	53,975,633
Land Cont.	17,052,075	11,505,413	13,782,525	9,267,863
Construction Cont.	101,638,881	166,751,749	283,531,472	293,167,356
Engineering Cont.	19,075,542	30,397,288	51,938,065	54,100,876
Supervision Cont.	10,290,949	17,972,365	30,076,442	30,663,533
Total Cont.	148,057,448	226,626,815	379,328,504	387,199,627
S.G.S.B.	510,437	785,114	609,022	754,898
C.B.C.	341,549	590,012	482,803	482,665
Asphalt	248,590	365,314	287,421	332,549
Concrete Barrier	52,900	128,060	196,500	158,900
Noise Attentuation Wall	0	0	0	0
No. of Light Poles	0	0	0	0
Sidewalk	0	0	0	0
Curb and Gutter	0	0	0	0
Signals	0	0	0	0
Total Rock	5,618,342	17,326,929	33,673,837	34,577,700
Total OM	1,331,937	8,171,675	13,111,161	11,525,900
Total Stripping	270,840	502,458	451,950	407,790
Total Borrow	0	0	0	0
Total Cut/Excavation	7,221,119	26,001,062	47,236,947	46,511,390
Total Fill	0	0	0	0
Surplus or Deficit	7,221,119	26,001,062	47,236,947	46,511,390
ENG & PM	146.246	233.046	398.192	414.77
LAND	130.733	88.208	105.666	71.05
CONST.	451.693	1312.051	1900.529	1683.16
BRIDGES-R/W	406.436	104.167	503.796	799.54
MANAGEMENT RESERVE	56.755	86.874	145.409	148.43
ESCALATION	0.000	0.000	0.000	0.00
TOTAL (Millions)	1191.863	1824.346	3053.594	3116.96

File: M:\Hwy 99 Route Study\Final Documents\[Van-Squamish Summary Estimates.xls]SUMOFSUMS			Seymour/Indian Arm Hybrid
npany	Con. Est.	**Vancouver - Squamish**	
	(2000 Dollars)	**Alternative Routes**	Conceptual Estimate
ACTIVITY CODE		**Conceptual Estimates** May 31, 2001	
		MAIN RD	56500
Blk Est. Version May 31/01		OTHER ROADS	0
		DESCRIPTION \TOTAL ROADS	56500
2500		PLANNING	
2521	Consultant	- transport. planning study	0
2531	Consultant	- corridor study	0
2541	Consultant	- functional plan. study	0
2502	Consultant	- general	0
	Consultant sub-total		0
2510	Ministry	- project ident.	0
2520	Ministry	- transport. planning study	0
2530	Ministry	- corridor study	0
2540	Ministry	- functional plan. study	0
2501	Ministry	- general	0
	Ministry Sub-total		0
2599	Planning Contingency		0
	TOTAL PLANNING		0
3000		PRELIMINARY DESIGN	
3013	Consultant	- aerial base plan	0
3014	Consultant	- mapping	705,000
3015	Consultant	- control survey	0
3021	Consultant	- environmental impact	211,500
3031	Consultant	- funct.-road field survey	564,000
3041	Consultant	- functional design	352,500
3051	Consultant	- funct. structural des.	6,390,866
3061	Consultant	- geotechnical design	211,500
3071	Consultant	- right-of-way research	1,350
3002	Consultant	- general	0
	Consultant sub-total		8,436,716
3010	Ministry	- aerial base plan	0
3011	Ministry	- mapping	0
3012	Ministry	- control survey	0
3020	Ministry	- environmental impact	0
3030	Ministry	- funct.-road field survey	0
3040	Ministry	- functional design	0
3050	Ministry	- funct. structural des.	0
3060	Ministry	- geotechnical design	0
3070	Ministry	- right-of-way research	0
3001	Ministry	- general	0
	Ministry Sub-total		0
3099	Preliminary design Contingency		1,265,507
	TOTAL PRELIMINARY DESIGN		9,702,224

File: M:\Hwy 99 Route Study\Print Documents\[Van-Squamish Summary Estimates.xls]SUMOFSUMS			Seymour/Indian Arm Hybrid
npany	Con. Est. (2000 Dollars	**Vancouver - Squamish Alternative Routes Conceptual Estimates** May 31, 2001	Conceptual Estimate
ACTIVITY CODE		MAIN RD	56500
Blk Est. Version May 310/01		OTHER ROADS	0
		DESCRIPTION \TOTAL ROADS	56500
6700		UTILITIES	
6710	Util. Prov.	- B.C. Hydro	705,000
6711	Util. Prov.	- B.C. telephone	0
	Util. Prov.	sub-total	705,000
6712	Util.Others	- pipelines	0
6713	Util.Others	- telecommunication	0
6714	Util.Others	- storm & sewer inspect.	0
6715	Util.Others	- waterworks inspect.	0
6716	Util.Others	- engineering services	0
6717	Util.Others	- parks/recreation-prel.	0
6718	Util.Others	- transit	0
6719	Util.Others	- tr-ops/signs & detours	0
6701	Util.Others	- general	0
	Util.Others	sub-total	0
6799	Util.Others	Contingency	105,750
	TOTAL UTILITIES		810,750
5000		GRADE CONSTRUCTION	
5032	Grade Const	- water	0
5033	Grade Const	- sanitary	0
5034	Grade Const	- storm	24,675,000
5031	Grade Const	- utility general	1,233,750
5039	Grade Const	- utility contingency	3,886,313
	Grade Const.	Utilities Sub-total	29,795,063
5010	Grade Const	- site prep./clear,grubbing	2,299,200
5020	Grade Const	- road grade/exc,placing,fill	691,308,389
5030	Grade Const	- drainage/pipe,cul.	2,834,372
5040	Grade Const	- multiplate	0
5050	Grade Const	-SGSB/produce,place,comp	13,825,297
5051	Grade Const	-CBC/produce,place,comp	10,561,078
5060	Grade Const	- grade finishing landscaping	0
5061	Grade Const	- grade finishing hydro seed.	782,056
5062	Grade Const	- grade finishing fencing	0
5063	Grade Const	- noise barriers	0
5064	Grade Const	- passing lanes	45,900,000
5090	Grade Const	- sidewalks,curb & gutter	0
5005	Grade Const	-detours c/w ex,bf,paving	3,140,006
5001	Grade Const	-urban design & general	23,119,512
5099	Grade Const	- Contingency	119,065,487
	Grade Construction Sub-total		912,835,398
	GRADE CONSTRUCTION COSTS		942,630,460
3510	Grade Eng.	- detailed design	65,984,132
3519	Grade Eng.	- detailed design/Contingency	9,897,620
6810	Grade Eng.	- general const. supervision	43,361,001
6811	Grade Eng.	- quality assurance	30,164,175
6812	Grade Eng.	- surveying	18,852,609
6819	Grade Eng.	- Residency Contingency	13,856,668
	Grade Engineering Sub-total		182,116,205
	Total Grade Const. & Eng. Costs		1,124,746,665

File: M:\Hwy. 99 Route Study\Print Documents\[Van-Squamish Summary Estimates.xls]SUMOFSUMS		Seymour/Indian Arm Hybrid
npany Con. Est. **Vancouver - Squamish**		
(2000 Dollars) **Alternative Routes**		Conceptual Estimate
ACTIVITY CODE **Conceptual Estimates** May 31, 2001		
	MAIN RD	56500
Blk Est.	OTHER ROADS	0
Version May.310/01	DESCRIPTION \TOTAL ROADS	56500
5500	STRUCTURAL CONSTRUCTION	
5522	Struct.Const - water	0
5523	Struct.Const - sanitary	0
5524	Struct.Const - storm	0
5521	Struct.Const - utility general	0
5599	Struct.Const - utility contingency	0
	Structural Const. Utilities Sub-total	0
5510	Struct.Const - tunnel site preparation	0
5511	Struct.Const - tunnel construction	1,030,425,547
5512	Struct.Const - snow shed site prep.	0
5513	Struct.Const - snow shed site const.	0
5514	Struct.Const - bridge site preparation	0
5515	Struct.Const - bridge piers	0
5516	Struct.Const - bridge abutments	0
5517	Struct.Const - bridge superstructure	0
5518	Struct.Const - retain. wall site prep.	0
5519	Struct.Const - retaining wall const.	48,657,000
5501	Struct.Const - general & urban design	32,372,476
5529	Struct.Const - Contingency	168,718,254
	Structural Construction Sub-total	1,278,173,277
	STRUCTURAL CONSTRUCTION COSTS	1,278,173,277
3520	Struct. Eng. - detailed design	95,862,996
3529	Struct. Eng. - detailed design/Contingency	14,379,449
6820	Struct. Eng. - general const. supervision	57,517,797
6821	Struct. Eng. - quality assurance	38,345,198
6822	Struct. Eng. - surveying	6,390,866
6829	Struct. Eng. - Residency Contingency	15,338,079
	Structural Engineering Sub-total	227,834,387
	Total Structural & Eng. Costs	1,506,007,664

File:	M:\Hwy 99 Route Study\Print Documents\[Van-Squamish Summary Estimates.xls]SUMOFSUMS	Seymour/Indian Arm Hybrid
npany	Con. Est. **Vancouver - Squamish**	
	(2000 Dollars) **Alternative Routes**	Conceptual Estimate
ACTIVITY CODE	**Conceptual Estimates** May 31, 2001	
	MAIN RD	56500
Blk Est. Version May 31/0/01	OTHER ROADS	0
	DESCRIPTION \TOTAL ROADS	56500
6000	PAVING CONSTRUCTION	
6020	Paving Cons - machine paving asphalt	15,498,834
6030	Paving Cons - machine paving concrete	0
6040	Paving Cons - hot reprofiling	0
6050	Paving Cons - shoulder paving	0
6060	Paving Cons - pavement finishing	0
6070	Paving Cons - seal coating	0
6001	Paving Cons - general	464,965
6010	Paving Cons - pavement design	0
6099	Paving Cons - Contingency	2,394,570
	PAVING CONSTRUCTION COSTS	18,358,368
3560	Paving Eng. - detailed design	1,285,086
3569	Paving Eng. - detailed design/Contingency	192,763
6860	Paving Eng. - general const. supervision	550,751
6861	Paving Eng. - quality assurance	917,918
6862	Paving Eng. - surveying	183,584
6869	Paving Eng. - Residency Contingency	247,838
	Paving Engineering Sub-total	3,377,940
	Total Paving Const. & Eng. Costs	21,736,308
6500	OPERATIONAL CONSTRUCTION	
6510	Operat.Cons - lighting	0
6520	Operat.Cons - signals	0
6530	Operat.Cons - signing	45,000
6540	Operat.Cons - guard rail	10,059,000
6550	Operat.Cons - pavement markings	390,425
6501	Operat.Cons - general	314,833
6599	Operat.Cons - contingency	1,621,389
	OPERATIONAL CONSTRUCTION COSTS	12,430,646
3540	Operat. Eng. - detailed design	870,145
3549	Operat. Eng. - detailed design/Contingency	130,522
6840	Operat. Eng. - general const. supervision	745,839
6841	Operat. Eng. - quality assurance	248,613
6842	Operat. Eng. - surveying	124,306
6849	Operat. Eng. - Residency Contingency	167,814
	Operational Engineering Sub-total	2,287,239
	Total Operational Const.& Eng.Costs	14,717,885

			Seymour/Indian Arm
File:	M:\Hwy. 99 Route Study\Print Documents\[Van-Squamish Summary Estimates.xls]SUMOFSUMS		Hybrid
npany	Con. Est.	**Vancouver - Squamish**	
	(2000 Dollars	**Alternative Routes**	Conceptual Estimate
ACTIVITY CODE		**Conceptual Estimates**	
		May 31, 2001	
		MAIN RD	56500
Blk Est. Version May.310/01		OTHER ROADS	0
		DESCRIPTION \TOTAL ROADS	56500
5200		ROAD SIDE CONSTRUCTION	
5203	RoadSide Cc	- water	0
5204	RoadSide Cc	- sanitary	0
5205	RoadSide Cc	- storm	0
5202	RoadSide Cc	- general	0
5209	RoadSide Cc	- Utility Contingency	0
	Road Side Const. Utilities Sub-total		0
5210	RoadSide Cc	- weighscales	0
5220	RoadSide Cc	- tourist info centers	0
5230	RoadSide Cc	- tourist rest & view areas	0
5201	RoadSide Cc	- general & urban design	0
5299	RoadSide Cc	- Contingency	0
	Road Side Construction Sub-total		0
	ROAD SIDE CONSTRUCTION COSTS		0
3550	RoadSide En	- detailed design	0
3559	RoadSide En	- detailed design/Contingency	0
6850	RoadSide En	- general const. supervision	0
6851	RoadSide En	- quality assurance	0
6852	RoadSide En	- surveying	0
6859	RoadSide En	- Residency Contingency	0
	Road Side Engineering Sub-total		0
	Total Road Side Const.& Eng.Costs		0
5300		OTHER CONSTRUCTION	
5303	Other Const.	- water	0
5304	Other Const.	- sanitary	0
5305	Other Const.	- storm	0
5302	Other Const.	- utility general	0
5309	Other Const.	- utility contingency	0
	Other Const. Utilities Sub-total		0
5310	Other Const.	- railroads main & spur lines	0
5320	Other Const.	- railroad crossings	0
5330	Other Const.	- marine work	0
5340	Other Const.	- environmental mitigations	302,663,549
5301	Other Const.	- general	0
5399	Other Const.	- Contingency	45,399,532
	Other Construction Sub-total		348,063,081
	OTHER CONSTRUCTION COSTS		348,063,081
3570	Other Eng.	- detailed design	24,409,416
3579	Other Eng.	- detailed design/Contingency	3,661,412
6870	Other Eng.	- general const. supervision	10,459,892
6871	Other Eng.	- quality assurance	10,441,892
6872	Other Eng.	- surveying	10,441,892
6879	Other Eng.	- Residency Contingency	4,701,552
	Other Engineering Sub-total		64,116,057
	Total Other Const.& Eng.Costs		412,179,138

Vancouver to Squamish
Alternative Routes
Conceptual Estimates

File: M:\Hwy 99 Route Study\Print Documents\[Van-Squamish Summary Estimates.xls]SUMOFSUMS		Seymour/Indian Arm Hybrid
npany Con. Est.	**Vancouver - Squamish**	
(2000 Dollar:	**Alternative Routes**	Conceptual Estimate
ACTIVITY CODE	**Conceptual Estimates** May 31, 2001	
	MAIN RD	56500
Blk Est. Version May.310/01	OTHER ROADS	0
	DESCRIPTION \TOTAL ROADS	56500
3500	DETAILED DESIGN from 3510,3520,3540,3550,3570	216,673,541
3530	Geotech. En - detailed design	19,404,189
3539	Geotech. En - Contingency	2,910,628
	TOTAL DETAILED DESIGN COSTS	238,988,358
6800	RESIDENT ENGINEERING from 6810,6820,6840,6850,6860,6870	263,058,286
	TOTAL RESIDENT ENG. COSTS	263,058,286
9700	RISK CONTINGENCY - general	0
	TOTAL RISK CONTINGENCY	0
	PART 1 SUMMARY	
	CONSTRUCTION	2,261,275,290
	ENGINEERING & SUPERVISION	444,999,016
	CONTRACTUAL CONTINGENCY	405,941,146
	RISK CONTINGENCY	0
	CONSTRUCTION COST TOTAL	3,112,215,451

	M:\Hwy 99 Route Study\Print Documents\[Van-Squamish		Seymour/Indian Arm
File:	Summary Estimates.xls]SUMOFSUMS		Hybrid
npany	Con. Est.	**Vancouver - Squamish**	
	(2000 Dollars	**Alternative Routes**	Conceptual Estimate
	ACTIVITY CODE	**Conceptual Estimates**	
		May 31, 2001	
		MAIN RD	56500
Blk Est.		OTHER ROADS	0
Version May 31/0/01		DESCRIPTION \TOTAL ROADS	56500
2000		PROJECT MANAGEMENT	
2060	Project Man.	- office costs wages	46,683,232
2062	Project Man.	- office costs - expenses	15,561,077
2063	Project Man.	- printing costs	0
2061	Project Man.	- general	0
	Project Manager Sub-total		62,244,309
2010	Ministry	- office costs wages	46,683,232
2012	Ministry	- office costs - expenses	15,561,077
2030	Ministry	- printing costs	0
2011	Ministry	- general	0
	Ministry Sub-total		62,244,309
2070	Public Rel.	- wages & expenses	17,117,185
2072	Public Rel.	- adv., media, displays	17,117,185
2073	Public Rel.	- opening ceremonies	9,000
2071	Public Rel.	- general	0
	Public Relations Sub-total		34,243,370
2040	Legal Costs	- lawyers fees	6,224,431
2041	Legal Costs	- general	0
	Legal Costs Sub-total		6,224,431
2080	Insurance	- const./ liability, E&O	38,902,693
2081	Insurance	- general	0
	Legal Costs Sub-total		38,902,693
2099	Project Management Contingency		30,578,867
	TOTAL PROJECT MANAGEMENT COSTS		234,437,979
4000		LAND	9
4010	Land(Code 4	-Mrkt,ROW,Serv,Imp.V,Ease.C,T	106,149,000
	Acquisition Sub-total		106,149,000
4020	Land(Code 4	-Bus.,5%,Mrg.P,Ret$,P/Tax,Etc	10,614,900
4030	Land(Code 4	-Owners(LS,Apprsl,Rprt,Lgl,In	7,430,430
4040	Land(Code 4	-Demolition	00,000
4050	Land(Code 4	-Pro.Man,P.Tax,Util,Security	1,061,490
4060	Land(Code 4	-Not Used	0
4070	Land(Code 4	-Not Used	0
4080	Land(Code 4	-Acq.F.M/Sal,Trvl/V,Cntr.S,Appr.	7,430,430
4090	Land(Code 4	-Surveys	18,000
			0
			0
			0
			0
	Associated costs-sub-total		26,645,250
4099	Land Contingency Sub-total		19,919,138
	TOTAL LAND COSTS		152,713,388

Vancouver to Squamish
Alternative Routes
Conceptual Estimates

File: M:\Hwy 99 Route Study\Print Documents\[Van-Squamish Summary Estimates.xls]SUMOFSUMS		Seymour/Indian Arm Hybrid
mpany Con. Est. (2000 Dollar ACTIVITY CODE	**Vancouver - Squamish Alternative Routes Conceptual Estimates** May 31, 2001	Conceptual Estimate
Blk Est. Version May 310/01	MAIN RD	56500
	OTHER ROADS	0
	DESCRIPTION \TOTAL ROADS	56500
9800	MANAGEMENT RESERVE	
MAN. RES.	- planning	0
MAN. RES.	- preliminary design	485,111
MAN. RES.	- utility construction	40,538
MAN. RES.	- grade construction	47,131,523
MAN. RES.	- structural construction	63,908,664
MAN. RES.	- paving construction	917,918
MAN. RES.	- operation construction	621,532
MAN. RES.	- roadside construction	0
MAN. RES.	- other construction	17,403,154
MAN. RES.	- project management	11,721,899
MAN. RES.	- land	7,635,669
MAN. RES.	- detailed eng.	11,949,418
MAN. RES.	- residency eng.	13,152,914
MAN. RES.	- risk contingency	0
	TOTAL MANAGEMENT RESERVE	174,968,341
	TOTAL LESS ESCALATION	
9900	FISCAL ESCALATION YEAR / PROJECTED ESCALATION	
9989	1999 - 200(0.5750%	0
9990	2000 - 2001 0.6250%	0
9991	2001 - 200(1.0000%	0
9992	2002 - 200(1.0000%	0
9993	2003 - 200(1.0000%	0
9994	2004 - 200(1.0000%	0
9995	2005 - 200(1.0000%	0
9996	2006 - 2007 1.0000%	0
9997	2007 - 200(1.0000%	0
	TOTAL ESCALATION	0
	PART 2 SUMMARY NON-CONSTRUCTION COST	
	Non-Construction	511,621,703
	Non-Const. Contingency	50,498,004
	TOTAL NON-CONSTRUCTION COST	562,119,707
	DIVISION TOTAL FOR ROAD TYPE	3,674,335,159

Vancouver to Squamish
Alternative Routes
Conceptual Estimates

File: M:\Hwy. 99 Route Study\Print Documents\[Van-Squamish Summary Estimates.xls]SUMOFSUMS npany Con. Est. **Vancouver - Squamish** (2000 Dollars **Alternative Routes** ACTIVITY CODE **Conceptual Estimates** May 31, 2001			Seymour/Indian Arm Hybrid Conceptual Estimate
		MAIN RD	56500
Blk Est. Version May.310/01		OTHER ROADS	0
		DESCRIPTION \TOTAL ROADS	56500
	SUMMARY BY ACTIVITY LEVEL		
2000		PROJECT MANAGEMENT	203,859,112
2500		PLANNING	0
3000		PRELIMINARY DESIGN	8,436,716
3500		DETAILED DESIGN	207,815,964
		Total Engineering	216,252,680
4000		LAND ACQUISITION	132,794,250
5000		GRADE CONSTRUCTION	819,678,661
5200		ROAD SIDE CONSTRUCTION	0
5300		OTHER CONSTRUCTION	302,663,549
5500		STRUCTURAL CONSTRUCTION	1,111,455,023
6000		PAVING CONSTRUCTION	15,963,799
6500		OPERATIONAL CONSTRUCTION	10,809,258
6700		UTILITY CONSTRUCTION	705,000
6800		RESIDENT ENGINEERING	228,746,336
			0
		Total Construction	2,490,021,625
9700		TENDER CONTINGENCY	456,439,150
		SUB-TOTAL	3,499,366,818
9800		MANAGEMENT RESERVE	174,968,341
		TOTAL	3,674,335,159
9900		ESCALATION	0
		TOTAL COST	3,674,335,159
		Const. Less Resident Eng.	2,261,275,290

File: M:\Hwy. 99 Route Study\Print Documents\[Van-Squamish Summary Estimates.xls]SUMOFSUMS		Seymour/Indian Arm Hybrid
npany Con. Est.	**Vancouver - Squamish**	
(2000 Dollars	**Alternative Routes**	Conceptual Estimate
ACTIVITY CODE	**Conceptual Estimates** May 31, 2001	
	MAIN RD	56500
Blk Est. Version May.310/01	OTHER ROADS	0
	DESCRIPTION \TOTAL ROADS	56500
	Engineering	483,128,561
	Land	152,713,388
	Construction	2,863,524,869
	Manage ent Reserve	174,968,341
	Escalation	0
	Total	3,674,335,159
	BASIC QUANTITY SUMMARY	
	Construct.Cost ONLY Per L.M.	51,782
	Land Area	0.0
	Mobilization	57,505,536
	Land Cont.	19,919,138
	Construction Cont.	339,191,293
	Engineering Cont.	63,016,769
	Supervision Cont.	34,311,950
	Total Cont.	456,439,150
	S.G.S.B.	591,607
	C.B.C.	378,443
	Asphalt	259,903
	Concrete Barrier	143,700
	Noise Attentuation Wall	0
	No. of Light Poles	0
	Sidewalk	0
	Curb and Gutter	0
	Signals	0
	Total Rock	25,162,411
	Total OM	10,099,261
	Total Stripping	330,510
	Total Borrow	0
	Total Cut/Excavation	35,592,182
	Total Fill	0
	Surplus or Deficit	35,592,182
	ENG & PM	483.13
	LAND	152.71
	CONST.	1585.35
	BRIDGES-R/W	1278.17
	MANAGEMENT RESERVE	174.97
	ESCALATION	0.00
	TOTAL (Millions)	3674.34

Highway 99

Date: May 31,2001

Unit Construction Costs for Reconstructon along Existing Highway 99

Squamish - Junction Hwy 99/ Hwy 97

Terrain Type	TYPICAL HEIGHT OF ROCK CUTS	CONSTRUCTION TYPE	UNIT COSTS (Millions/Km)		
			RECONSTRUCT AND Add **1** Lane	RECONSTRUCT AND Add **2** Lanes	RECONSTRUCT AND Add **2+** Lanes
FLAT TO UNDULATING	0-3 m	EASY	0.5	0.8	1.2
UNDULATING TO ROUGH	3-15 m	MODERATE	1.2	1.8	2.5
ROUGH	15-40 m	[redacted]	2.2	3.0	4.5
VERY ROUGH	>40	EXTREMELY HEAVY	3.5	5.0	7.0

Notes

1. Under the Number of Lanes Added, **1 Lane** also includes where only the shoulders will be widened, Where there are no lanes added just realignment of existing lanes, or where a medin only is added.
2. Under the Number of Lanes Added, **2+ Lanes** refers to **2 Lanes** plus Median.
3. Under the Number of Lanes Added, **2 Lanes** also means 1 Lane plus Truck Climbing Lane or **1 lane** plus Median.

Highway 99 Date: May 31 2001

Squamish - Junction Hwy 99/ Hwy 97

Terrain Type	TYPICAL HEIGHT OF ROCK CUTS	CONSTRUCTION TYPE	UNIT COSTS (Millions/Km) RECONSTRUCT AND Add **1** Lane	RECONSTRUCT AND Add **2** Lanes	RECONSTRUCT AND Add **2+** Lanes
FLAT TO UNDULATING	0-3 m	EASY	0.5	0.8	1.2
UNDULATING TO ROUGH	3-15 m	MODERATE	1.2	1.8	2.5
ROUGH	15-40 m	HEAVY	2.2	3.0	4.5
VERY ROUGH	>40	EXTREMELY HEAVY	3.5	5.0	7.0

Notes

1. Under the Number of Lanes Added **1 Lane** also includes where only the shoulders will be widened. Where there are no lanes added just realignment of existing lanes, or where a median only is added.
2. Under the Number of Lanes Added **2+ Lanes** refers to **2 Lanes** plus Median.
3. Under the Number of Lanes Added **2 Lanes** also means 1 Lane plus Truck Climbing Lane or **1 lane** plus Median.

Summary

Squamish to Whistler (3 Lane Divided)

Section	Cost in Millions		
Brackendale to Brohm Lake	13.5		(mainly add median barrier to existing 3-lane)
Brohm Lake to Cheakamus Canyon	33.8		(mainly add median barrier to existing 3 and 4 lane)(Also includes Culliton to Cheakamus Design cost)
Cheakamus Canyon to Salt Shed	37.5		(includes 2 lane tunnel)
Daisy Lake to Callahan Creek	24.6		(includes Civil Defense Zone cost)
Callahan Creek to Powerline Hill	8.9		
Power line Hill to Function Junction	6.6		
Function Junction to Whistler (North)	64.60		(Includes Whistler Bypass)
Road Construction Total	189.50	Millions	
Environmental Mitigation 5%	9.48		
Construction Total	198.98	millions	

Summary

Squamish to Whistler (4 Lane Divided)

Section	Cost in Millions		
Brackendale to Brohm Lake	18.9		
Brohm Lake to Culliton Creek	36.8		(includes Culliton - Cheakamus cost)
Cheakmus Canyon to Salt Shed	47.5		(includes tunnel)
Daisy Lake to Callahan Creek	39.0		(includes Civil Defense Zone realignment cost)
Callahan Creek to Powerline Hill	13.0		
Power line Hill to Function Junction	9.9		
Function Junction to Whistler (North)	64.60		(includes Whistler Bypass and exist. Hwy through Whistler)
Road Construction Total	229.72	Millions	
Environmental Mitigation 5%	11.49		
Construction Total	241.20	millions	
Bridges	21.00	Millions	

Whistler to Pemberton			
Green Lake to Suicide Hill	35.39		(includes Suicide Hill realignment)
Suicide Hill to Pemberton	3.82		
Road Construction Total	39.21	Millions	
Environmental Mitigation 5%	1.96		
Construction Total	41.17	millions	
Bridges	4.40	Millions	

Pemberton to Lillooet			
Pemberton to Joffre Pit)	69.8		(includes dyke route and ascent to Duffy Lake)(new alignment)
Joffre Pit to Duffey Lake	7.0		
Duffey Lake to Km 98	36.2		
Duffey Lake Road Km 98 to Km 109	14.0		
Duffey Lake Road Km 109 to Seton Lake	217.6		(includes descent down to Seton Lk)(new alignment)
Seton Dam to Lillooet	3.5		
Road Construction Total	348.05	Millions	
Environmental Mitigation 5%	17.40		
Construction Total	365.45	millions	
Bridges and Snow Sheds	21.20	Millions	

Lillooet to Hwy 97			
Lillooet to Fountain Valley	22.7		(includes new alignment at Fountain Valley)
Fountain Valley to Glenn Fraser	3.8		
Glenn Fraser to Pavillion Lake	2.0		
Pavillion Lake to Tourquoise Lake	27.6		
Tourquoise Lake to Spring Creek	12.9		
Spring Creek to Hwy 97	14.3		
Road Construction Total	83.25	Millions	
Environmental Mitigation 5%	4.16		
Construction Total	87.41	millions	
Bridges	10.10	Millions	

Construction Summary

Squamish to Whistler (4 Lane Divided)	241.20	Millions
Whistler to Pemberton	41.17	Millions
Pemberton to Lillooet	365.45	Millions
Lillooet to Hwy 97	87.41	Millions
Total	735.23	Millions

Appendix E

Project Team Members

- ***L.M. (Lawren) Wagar, P.Eng.***
  Regional Manager, Engineering
  South Coast Region
  …Project Manager, and representing First Nations issues

- ***Don Smith, P.Eng.***
  Corridor Planning Engineer
  South Coast Region
  …representing Highway Planning

- ***Gebre Libsekal, P.Eng.***
  Senior Highway Design Engineer
  South Coast Region
  …representing Highway Design and Survey

- ***Keith Tompkins***
  Highway Design Technician and Design team leader
  South Coast Region

- ***Al Brown, P.Eng.***
  Manager, Geotechnical & Materials Engineering
  South Coast Region
  …representing Geotechnical & Materials

- ***Greg Czernick***
  Manager, Environmental Services
  South Coast Region
  …representing Environmental

- ***Allan Galambos, P.Eng.***
  Senior Bridge Rehabilitation Engineer
  South Coast Region
  …representing Bridges

- ***Gordon Bonwick***
  Senior Snow Avalanche Technician
  Headquarters
  …representing Snow Avalanche

- ***Dean Lange***
  Property Agent
  South Coast Region
  …representing Properties

- ***Brian Lee, Randy Grelson, and Wes Wiebe***
  Area Managers of North Vancouver, Squamish and Lillooet respectively
  …representing district operations